A NATIONAL PERSPECTIVE ON A REGIONAL PROBLEM – MATERNAL MORTALITY IN 2017

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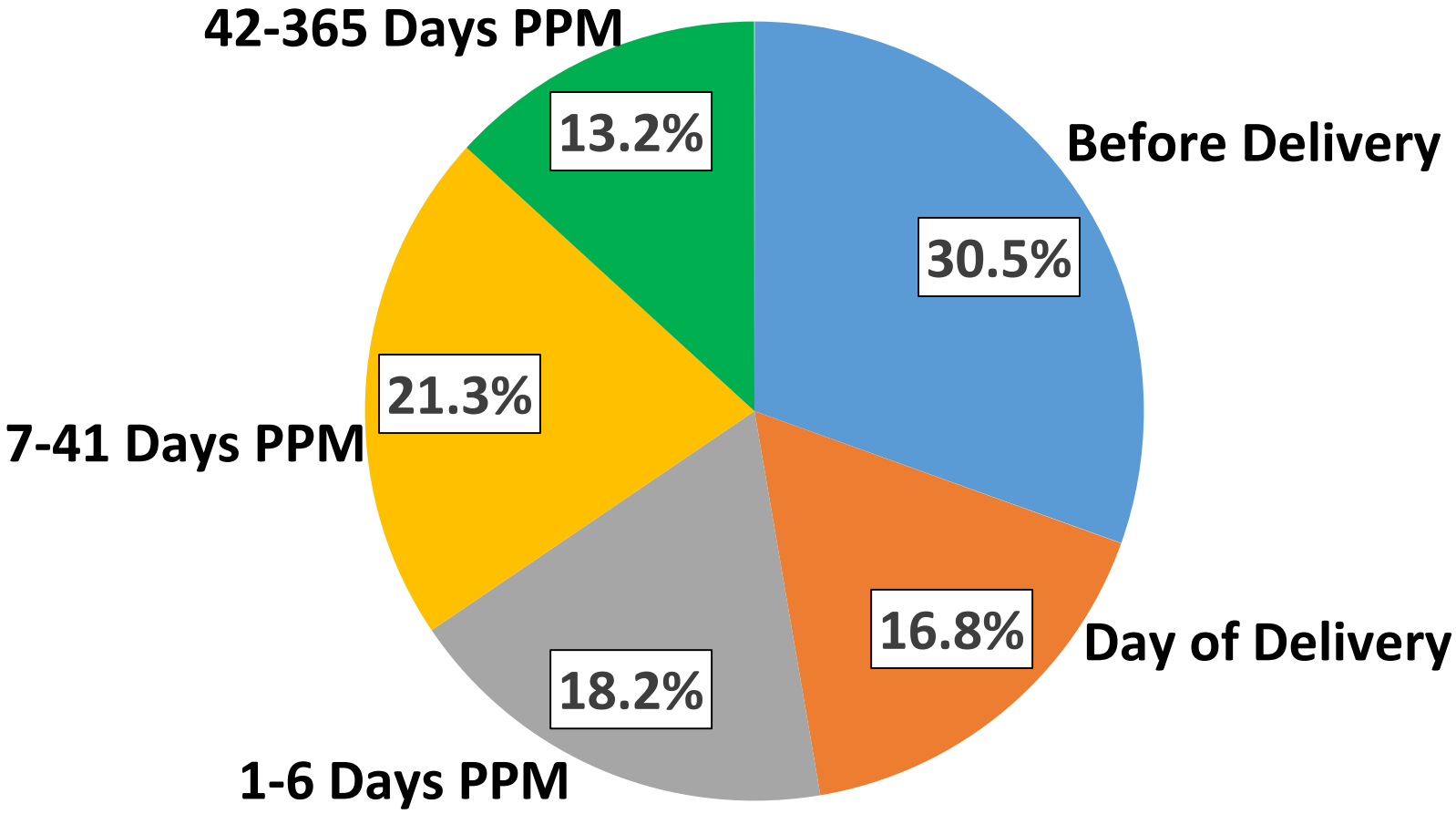
New England Regional Summit on Maternal Mortality
September 28, 2017

Two key background themes in this talk

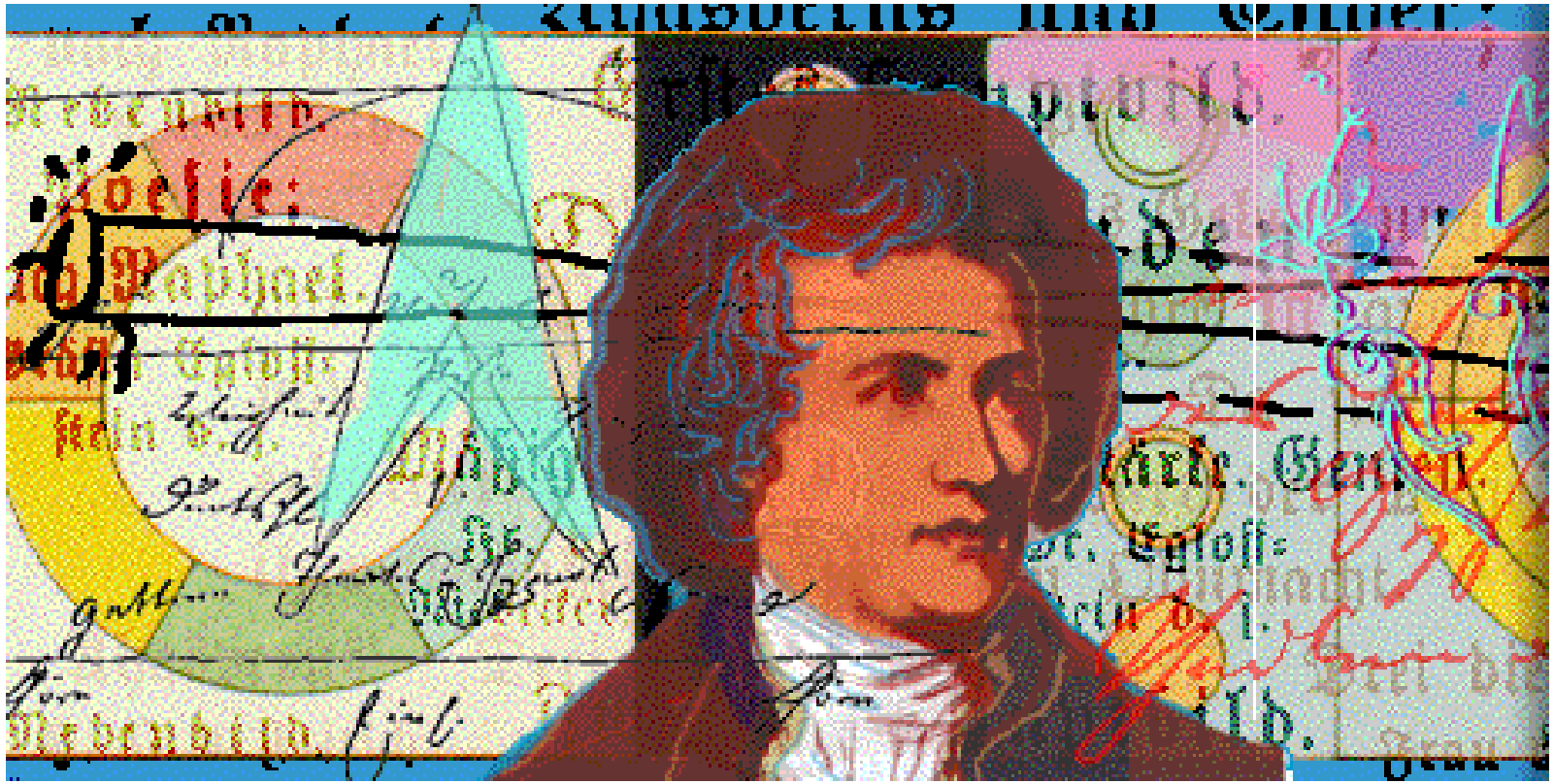
Timing of Maternal Deaths



Source: Creanga A et al. Pregnancy Related Mortality in the U.S., 2011-2013. *Obstet & Gynec* 2017.

(1) Implication of this distribution is that any attempt to resolve the problem of maternal death that doesn't encompass both clinical and public health approaches is destined to miss a significant portion of women at risk

(2) “Looking where there’s light”



“One searches where there is light”

Goethe 1749–1832

Source: Barry. *The Great Influenza*. 2004 p. 71

From Listening to Mothers 1

- Women surveyed in May & June, 2002 about their childbirth experiences. Included if they gave birth within 2 years prior to survey

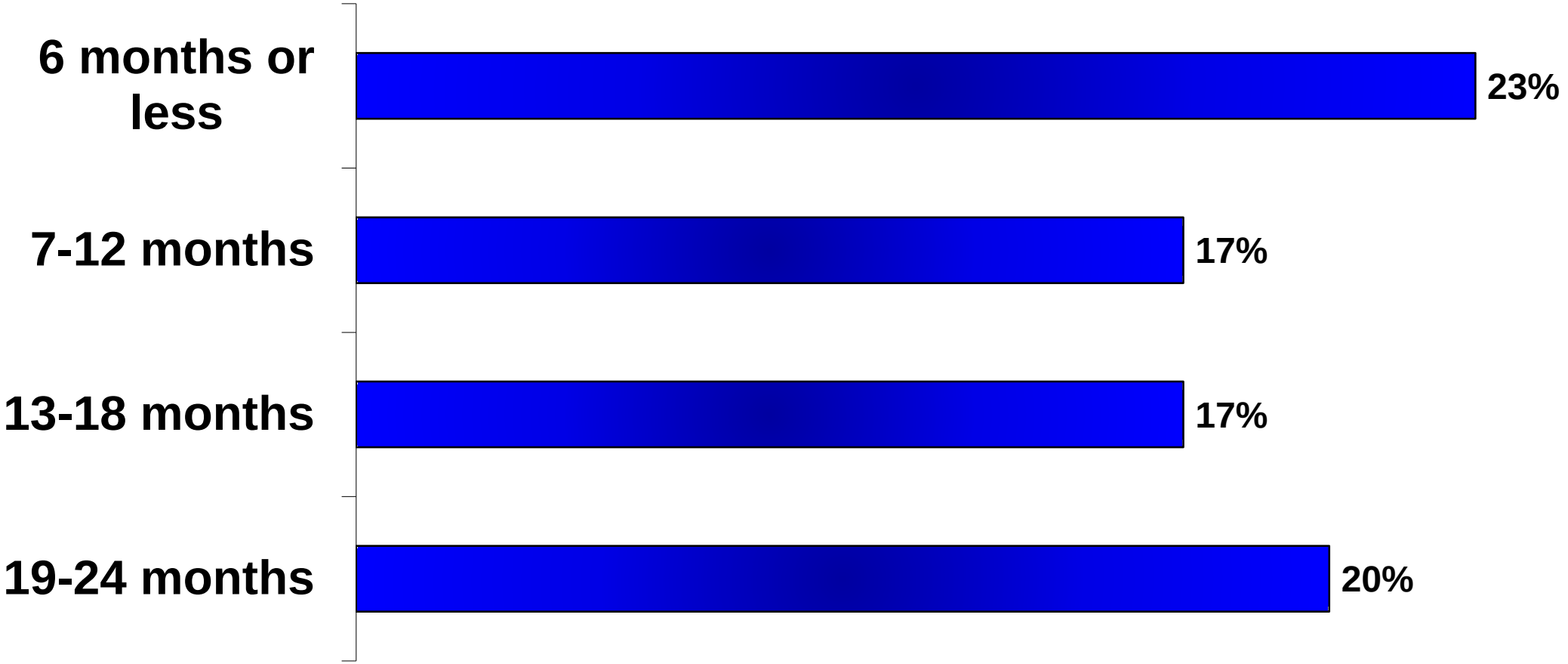
Postpartum Depression

- *19% of mothers scored 13+ on the Edinburgh Postnatal Depression Scale, meaning they were probably experiencing some degree of depression in the week preceding the survey.*

- *Only 43% of this group had consulted a professional about their mental health since giving birth.*

What happened when this overall finding was stratified by time since birth?

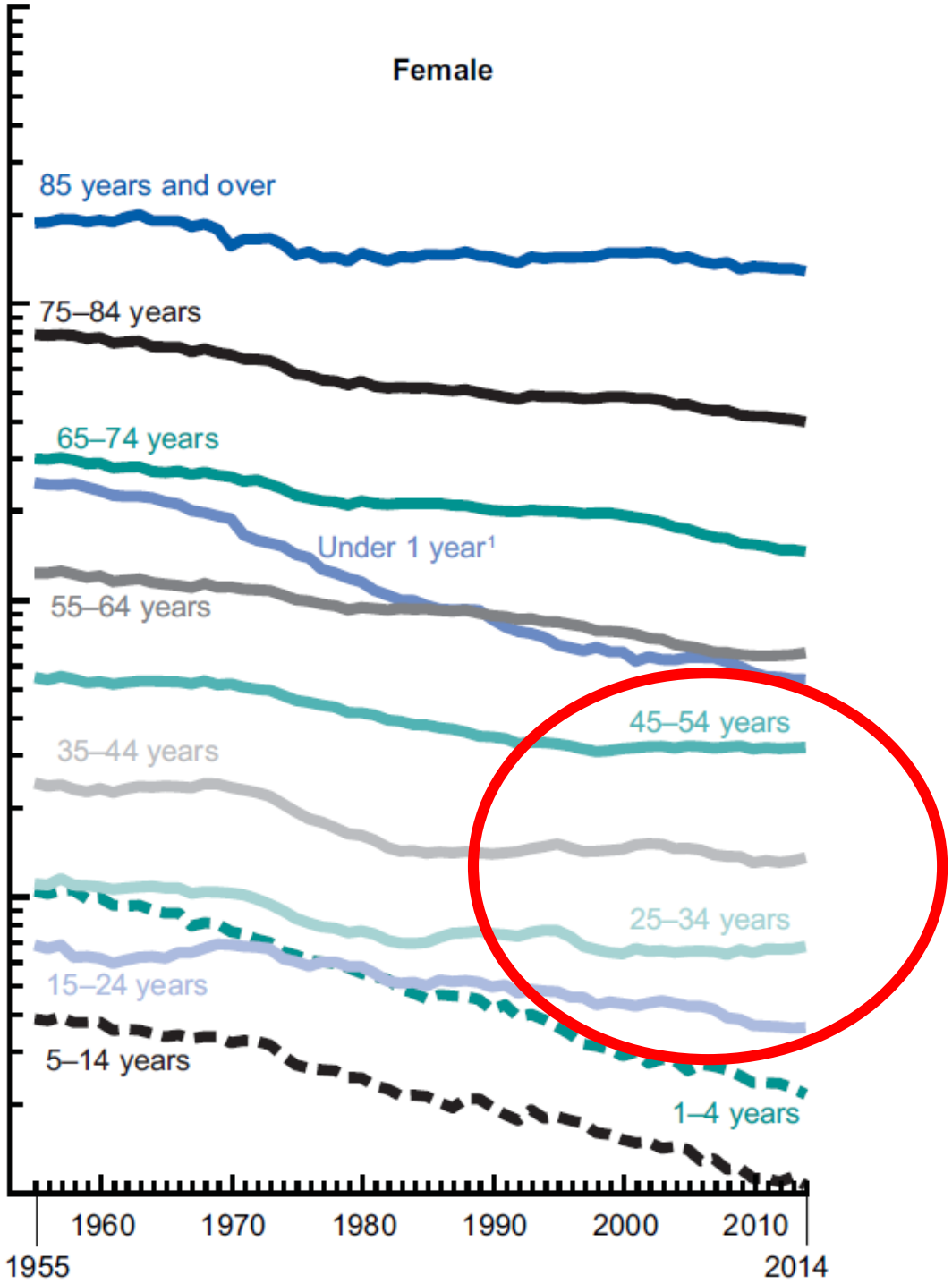
Proportion of Women Scoring 13 + on Edinburgh Postnatal Depression Scale



How much of what we term postpartum depression is chronic depression we happen to be measuring at that point in time?

What does this have to do with maternal mortality?

How much of what we're measuring as "the unacceptable level of maternal mortality" is actually capturing a general problem in the health of women of reproductive age and we have chosen to shine a light on it for the period of conception to 1 year postpartum?



Death rates, by age, females: United States, 1955–2014

Number of female deaths, 15-49 in 2014 75,192.

Maternal deaths = ~1% of all those.

Source: NCHS. *Deaths, Final Data for 2014*

So, as we turn the focus to maternal mortality, keep this larger context in mind:

if we are going to improve maternal mortality rates we need to improve <u>all</u> women's health – not just pregnant women's health.

Maternal Mortality in the U.S.

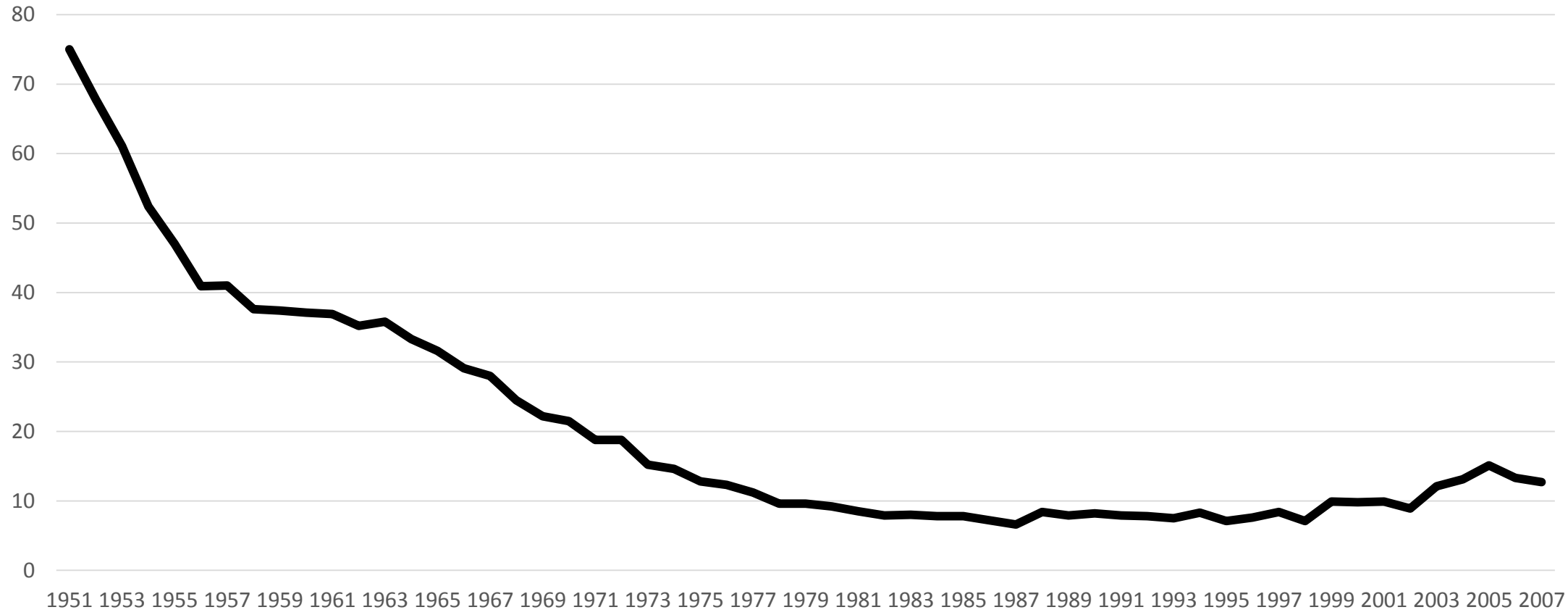
Definitions (in the U.S.)

- **Maternal Mortality Ratio** – the death of a woman ***while pregnant or within 42 days of termination of pregnancy***, irrespective of the duration and site of the pregnancy, from any cause ***related to or aggravated by the pregnancy*** or its management but not from accidental or incidental causes. Typically reported as a ratio per 100,000 births.

- **Pregnancy Related Death** – the death of a woman during pregnancy or ***within one year*** of the end of pregnancy from a pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiologic effects of pregnancy.

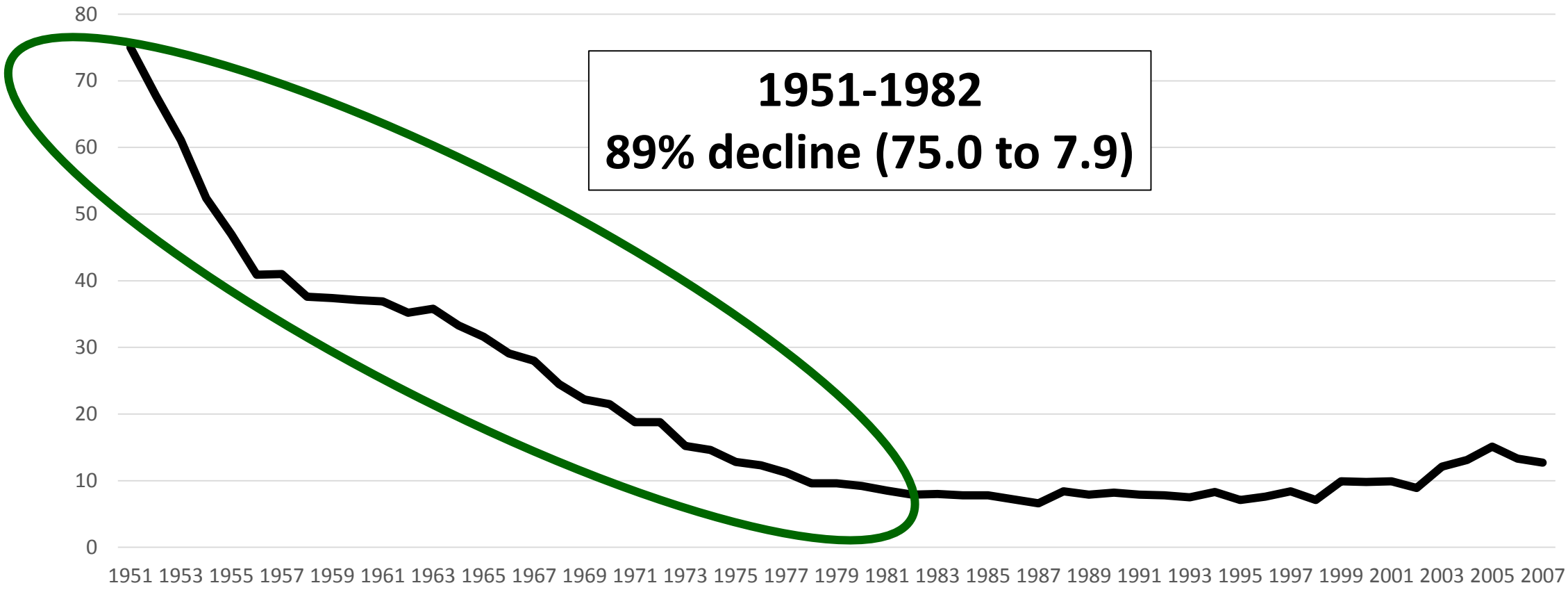
- **Pregnancy Associated Death** – The death of a women while pregnant or ***within one year*** of termination of pregnancy, ***irrespective of cause. (WHO calls these "pregnancy related")***

U.S. Maternal Mortality (per 100,000 live births), 1951-2007



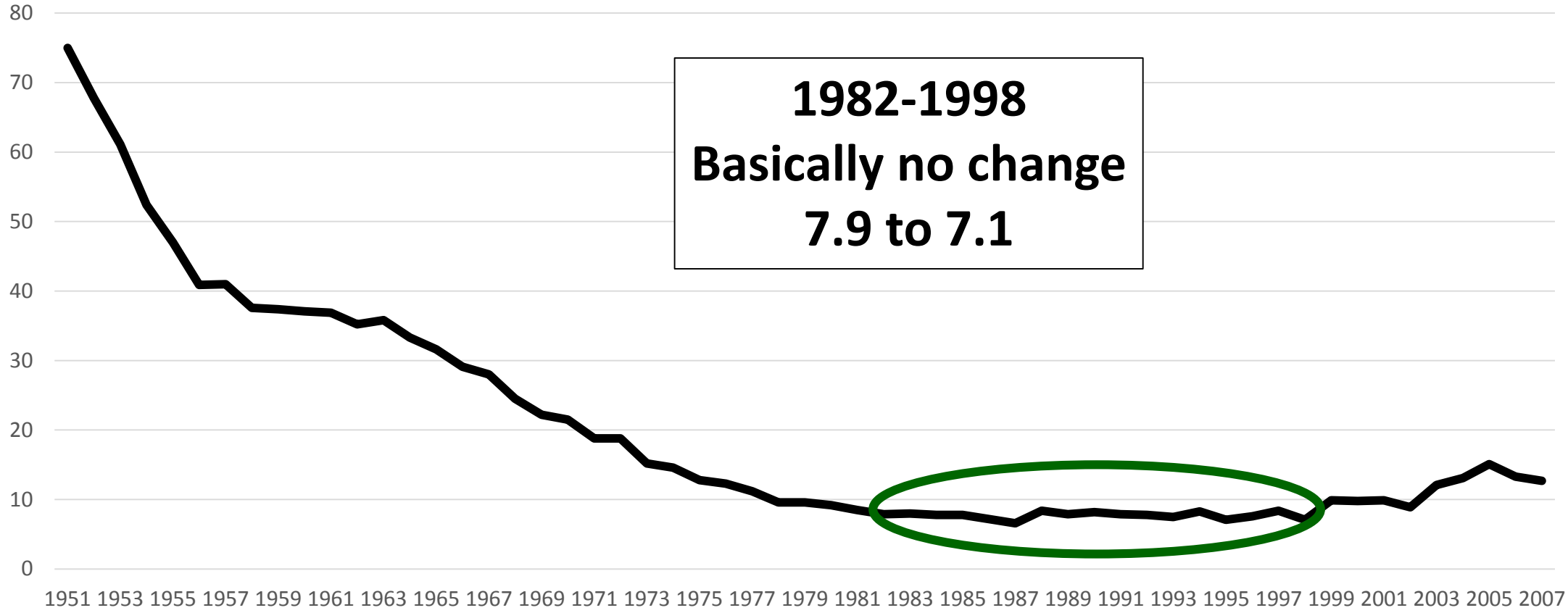
Source: NCHS. Deaths: Final Data. Annual Reports.

U.S. Maternal Mortality (per 100,000 live births), 1951-2007



Source: NCHS. Deaths: Final Data. Annual Reports.

U.S. Maternal Mortality (per 100,000 live births), 1951-2007



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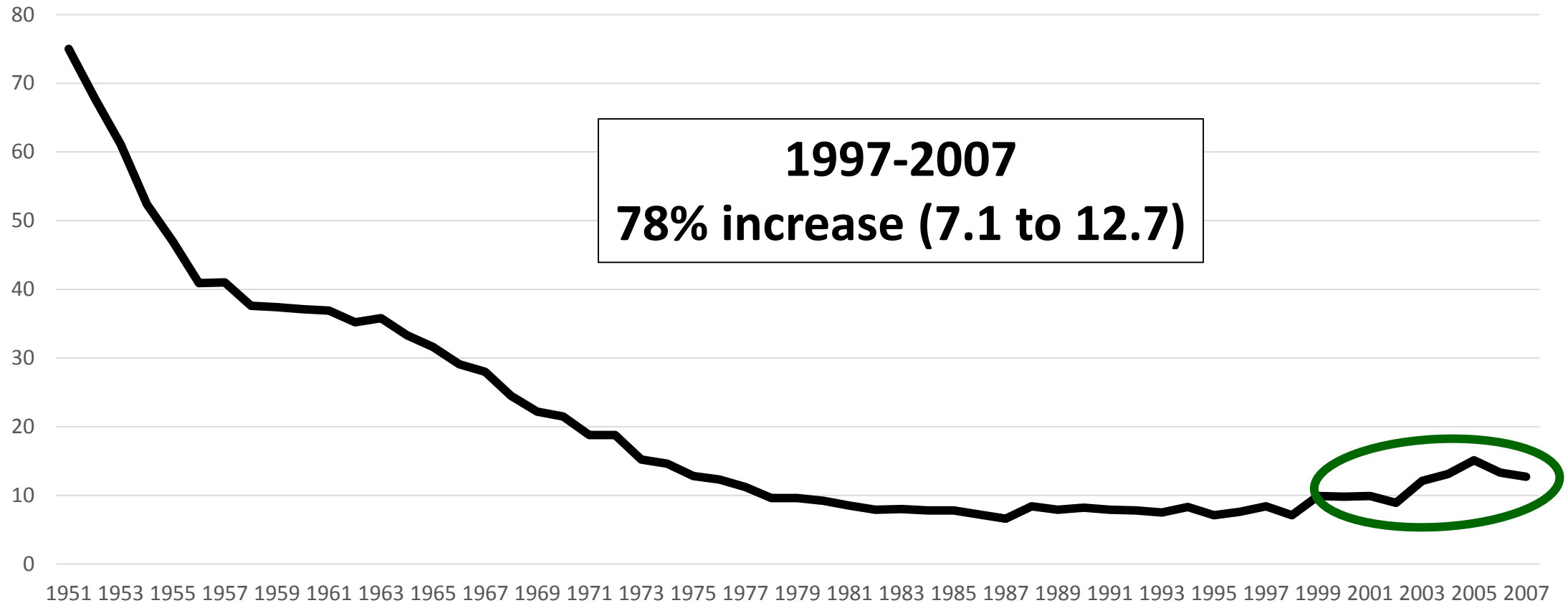

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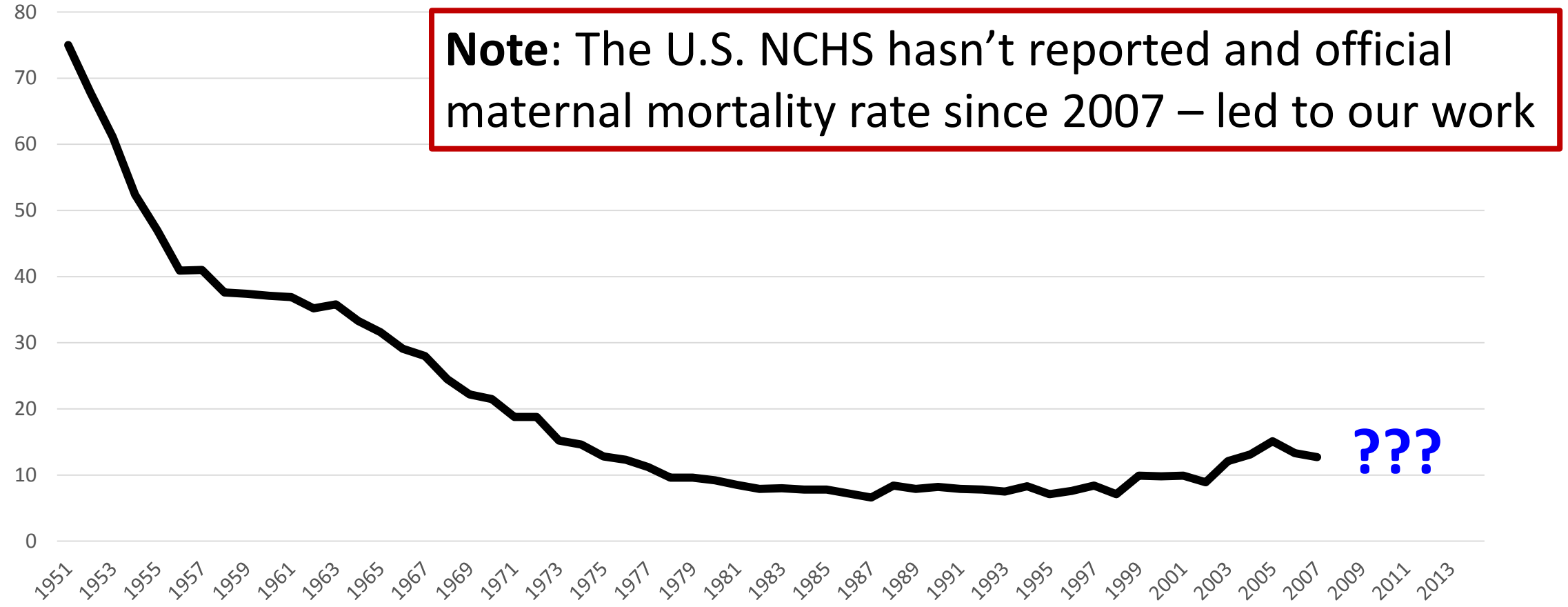


Note: The U.S. NCHS hasn't reported and official maternal mortality rate since 2007 – led to our work

Source: NCHS. Deaths: Final Data. Annual Reports.

Last reporting (2007)of a maternal mortality rate by NCHS

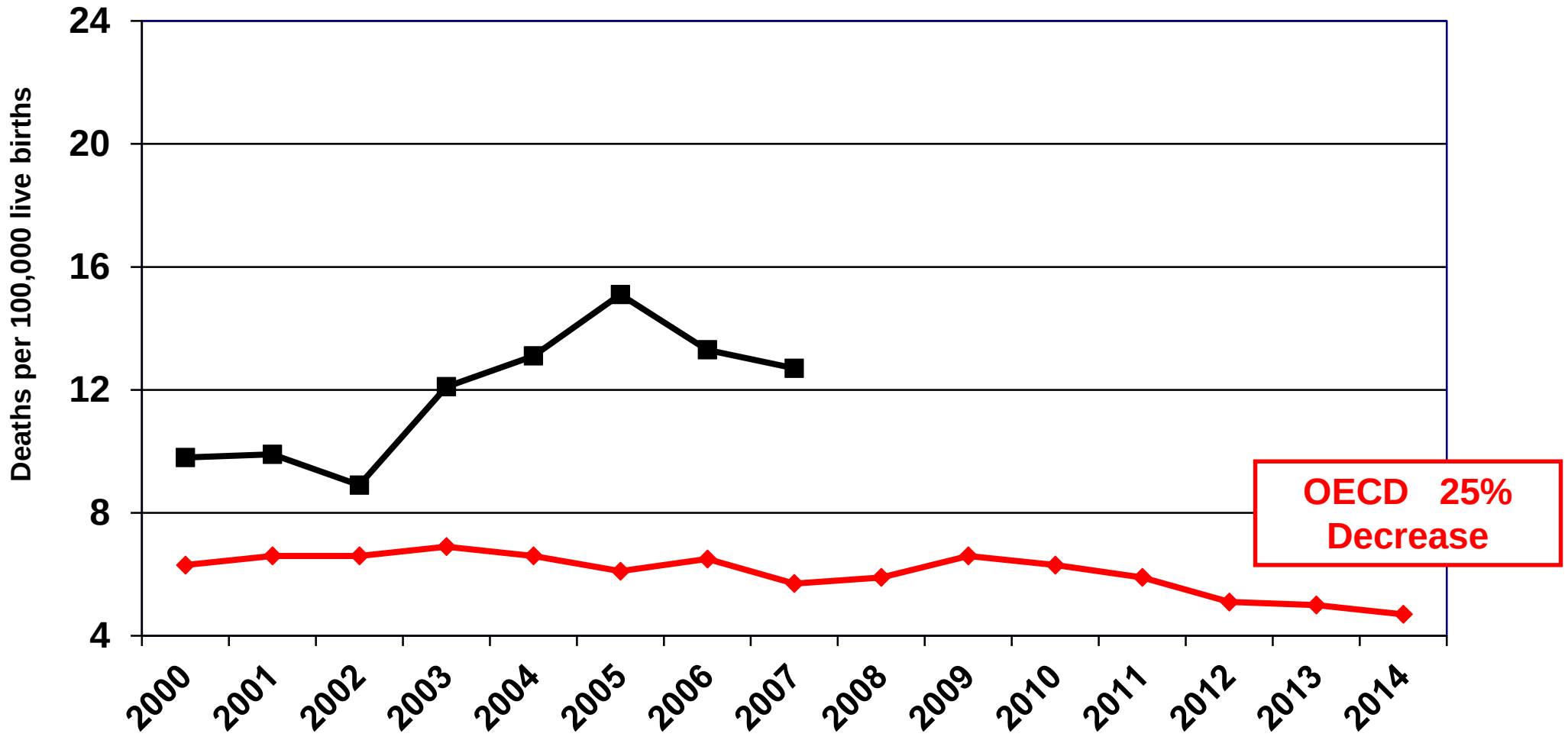
Table 34. Number of maternal deaths and maternal mortality rates for selected causes, by Hispanic origin and race for non-Hispanic population: United States, 2007

[Maternal causes are those assigned to categories A34, O00–O95, and O98–O99 of the *International Classification of Diseases, Tenth Revision* (ICD–10), Second Edition. An increasing number of states use a separate item regarding pregnancy status on the death certificate to help identify these deaths; see "Technical Notes." Rates are per 100,000 live births in specified group; see "Technical Notes." Race and Hispanic origin are reported separately on the death certificate. Persons of Hispanic origin may be of any race. Data for Hispanic persons are not tabulated separately by race; data for non-Hispanic persons are tabulated by race. Data for Hispanic origin should be interpreted with caution because of inconsistencies between reporting Hispanic origin on death certificates and on censuses and surveys; see "Technical Notes"]

Cause of death (based on ICD–10, 2004)	Number					Rate				
	All origins[1]	Hispanic	Non-Hispanic[2]	Non-Hispanic white[3]	Non-Hispanic black[3]	All origins[1]	Hispanic	Non-Hispanic[2]	Non-Hispanic white[3]	Non-Hispanic black[3]
Maternal causes (A34,O00–O95,O98–O99)	548	95	453	242	178	12.7	8.9	14.1	10.5	28.4
Pregnancy with abortive outcome (O00–O07)	31	5	26	8	17	0.7	*	0.8	*	*
Ectopic pregnancy (O00)	14	1	13	2	11	*	*	*	*	*
Spontaneous abortion (O03)	9	2	7	3	3	*	*	*	*	*
Medical abortion (O04)	–	–	–	–	–	*	*	*	*	*
Other abortion (O05)	1	–	1	–	1	*	*	*	*	*
Other and unspecified pregnancy with abortive outcome (O01–O02,O06–O07)	7	2	5	3	2	*	*	*	*	*
Other direct obstetric causes (A34,O10–O92)	362	67	295	153	117	8.4	6.3	9.2	6.6	18.7
Eclampsia and pre–eclampsia (O11,O13–O16)	64	13	51	29	19	1.5	*	1.6	1.3	*
Hemorrhage of pregnancy and childbirth and placenta previa (O20,O44–O46,O67,O72)	41	12	29	18	9	0.9	*	0.9	*	*
Complications predominately related to the puerperium (A34,O85–O92)	93	15	78	35	31	2.2	*	2.4	1.5	4.9
Obstetrical tetanus (A34)	–	–	–	–	–	*	*	*	*	*
Obstetric embolism (O88)	33	6	27	12	8	0.8	*	0.8	*	*
Other complications predominately related to the puerperium (O85–O87,O89–O92)	60	9	51	23	23	1.4	*	1.6	1.0	3.7
All other direct obstetric causes (O10,O12,O21–O43,O47–O66,O68–O71,O73–O75)	164	27	137	71	58	3.8	2.5	4.3	3.1	9.2
Obstetric death of unspecified cause (O95)	20	4	16	7	7	0.5	*	*	*	*
Indirect obstetric causes (O98–O99)	135	19	116	74	37	3.1	*	3.6	3.2	5.9
Maternal causes more than 42 days after delivery or termination of pregnancy (O96–O97)	221	39	181	92	70	5.1	3.7	5.6	4.0	11.2
Death from any obstetric cause occurring more than 42 days but less than 1 year after delivery (O96)	215	38	176	92	66	5.0	3.6	5.5	4.0	10.5
Death from sequelae of direct obstetric causes (O97)	6	1	5	–	4	*	*	*	*	*

Impetus for our Study

*Maternal Mortality Ratios (per 100K births), 2000-2014, U.S. & Comparable Countries **



* Countries with **300,000**+ births (2012): Australia, Canada, France, Germany, Italy, Japan, S. Korea, Spain, United Kingdom

Sources: OECD Health Data 2017; NCHS. 2009. *Deaths, Final Data, 2007*.

So has there been any way to monitor maternal death since 2007?

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CDC and Pregnancy Related Mortality

Pregnancy Mortality Surveillance System

Reproductive Health
About Us +
Data and Statistics +
Emergency Preparedness +
Maternal and Child Health Epidemiology Program +
Pregnancy Risk Assessment Monitoring System
Infertility +
Assisted Reproductive Technology (ART)
Depression Among Women +
Maternal and Infant Health −
Pregnancy Complications +
Weight Gain During Pregnancy
Tobacco Use and Pregnancy +
Pregnancy-Related Deaths −
Pregnancy Mortality Surveillance System
Perinatal Quality Collaboratives +
Preterm Birth +

Pregnancy Mortality Surveillance System

When did CDC start conducting national surveillance of pregnancy-related deaths?

CDC initiated national surveillance of pregnancy-related deaths in 1986 because more clinical information was needed to fill data gaps about causes of maternal death.

How does CDC define pregnancy-related deaths?

For reporting purposes, a pregnancy-related death is defined as the death of a woman while pregnant or within 1 year of pregnancy termination—regardless of the duration or site of the pregnancy—from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.

How are the data collected and coded?

Each year, CDC requests the 52 reporting areas (50 states, New York City, and Washington DC) to voluntarily send copies of death certificates for all women who died during pregnancy or within 1 year of pregnancy, and copies of the matching birth or fetal death certificates, if they have the ability to perform such record links. All of the information obtained is summarized, and medically trained epidemiologists determine the cause and time of death related to the pregnancy. Causes of death are coded by using a system established in 1986 by the American College of Obstetricians and Gynecologists and the Centers for Disease Control and Prevention Maternal Mortality Study Group.

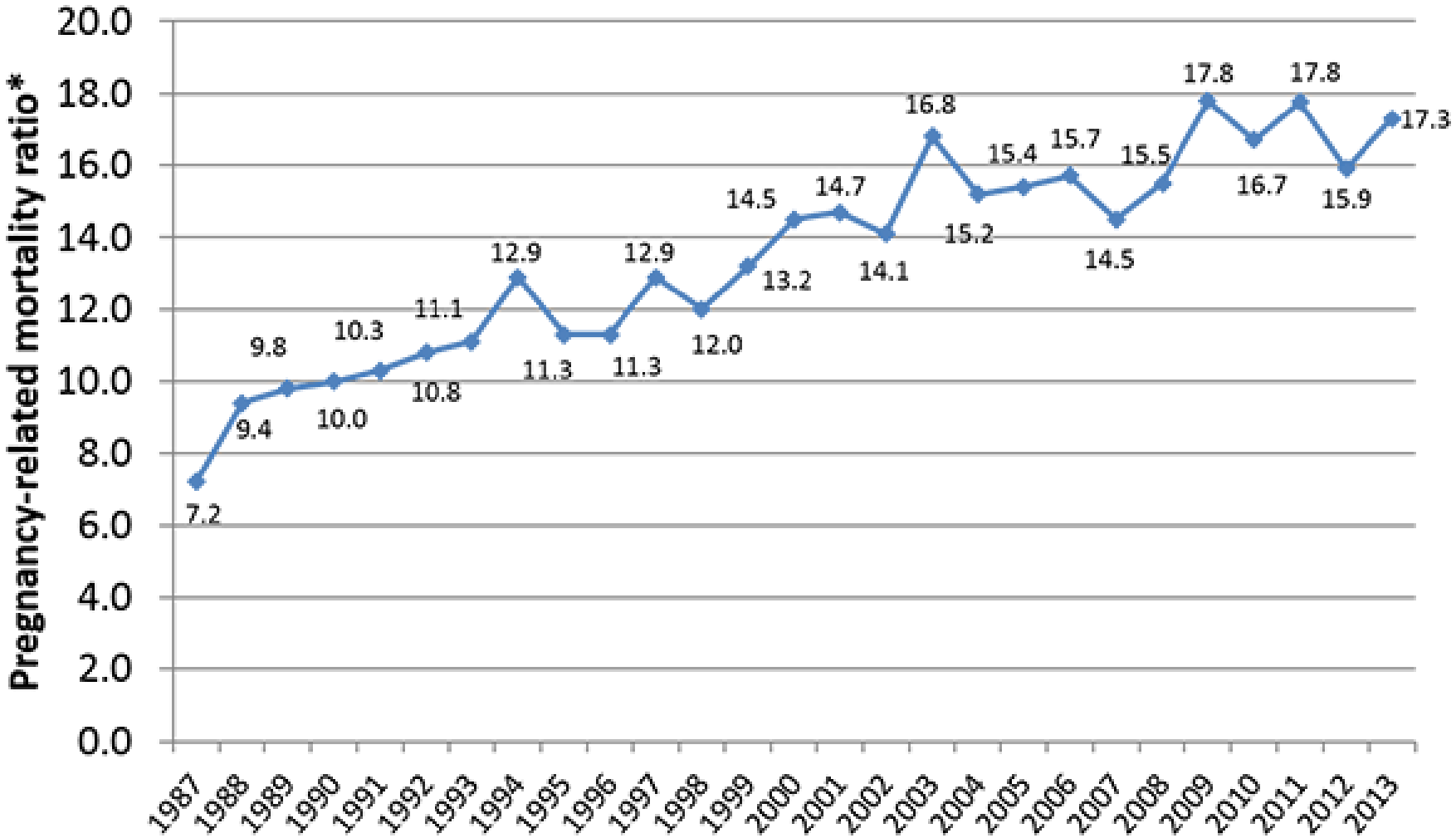
How are the data used?

Data are analyzed by CDC scientists. Information about causes of pregnancy-related deaths and risk factors associated with these deaths is released periodically through peer-reviewed literature, CDC's *Morbidity and Mortality Weekly Reports*, and the CDC Web site. This information helps clinicians and public health professionals to better understand circumstances surrounding pregnancy-related deaths and to take appropriate actions to prevent them.

Data for CDCs Pregnancy Related Mortality System

Each year, CDC requests the 52 reporting areas (50 states, New York City, and Washington DC) to ***voluntarily send copies of death certificates for all women who died during pregnancy or within 1 year of pregnancy, and copies of the matching birth or fetal death certificates,*** *if they have the ability to perform such record links. All of the information obtained is summarized, and medically trained epidemiologists determine the cause and time of death related to the pregnancy. Causes of death are coded by using a system established in 1986 by the American College of Obstetricians and Gynecologists and the Centers for Disease Control and Prevention Maternal Mortality Study Group.*

Pregnancy Related Mortality, U.S., 1987-2013



Note: Number of pregnancy-related deaths per 100,000 live births per year.

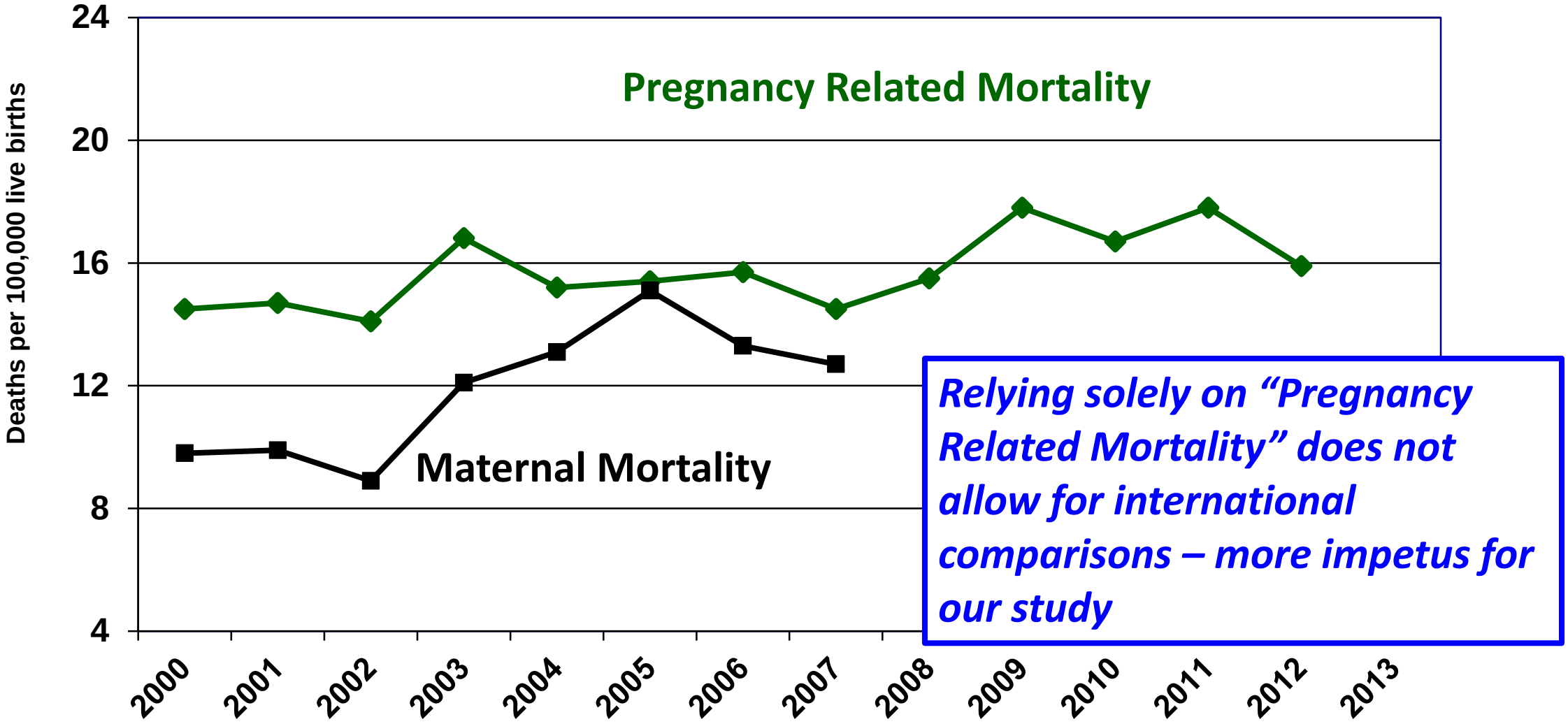
Racial Disparities

Rates for 2011-13:

12.7 white women
43.5 black women
11.0 Hispanic
14.4 other races

Source: CDC.
Creanga. Pregnancy-Related Mortality in the United States. *Obstet Gynecol 2017*.

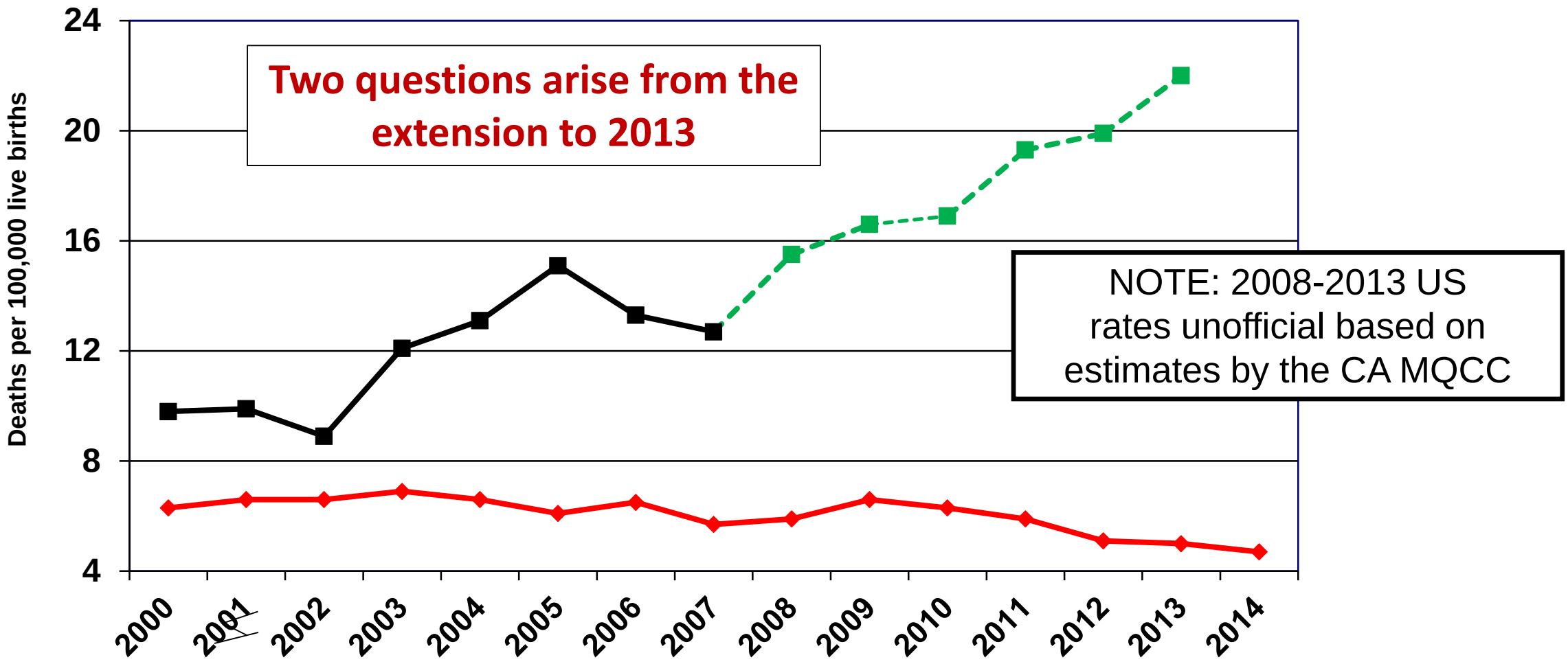
U. S. Maternal Mortality & Pregnancy Related Ratios (per 100,000 live births), 2000-2013



Relying solely on "Pregnancy Related Mortality" does not allow for international comparisons – more impetus for our study

Impetus for our Study

Maternal Mortality Ratios (per 100K births), 2000-2013, U.S. & Comparable Countries*



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Sources: OECD Health Data 2017; ^California Maternal Quality Care Collaborative (CMQCC) 2014; NCHS. 2009. *Deaths, Final Data, 2007*.

Impetus for our Study

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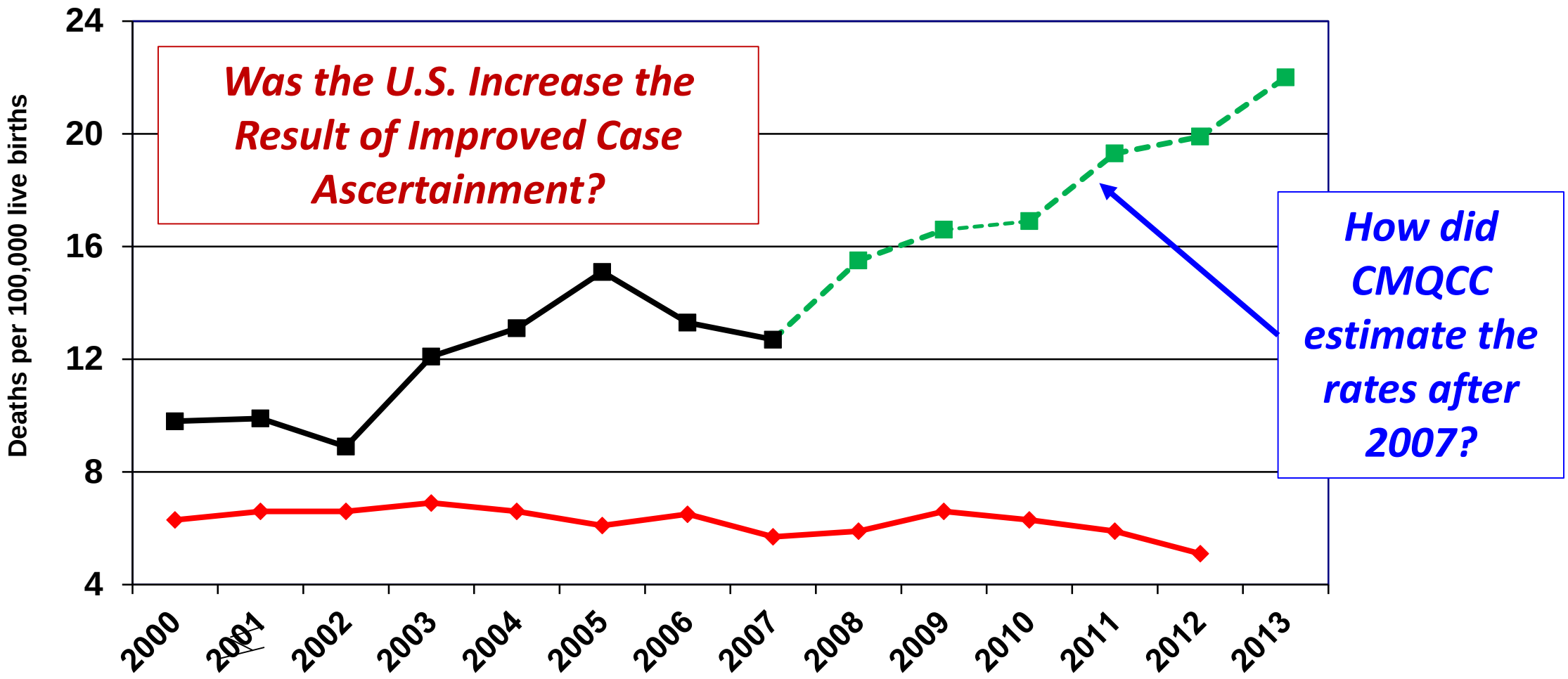

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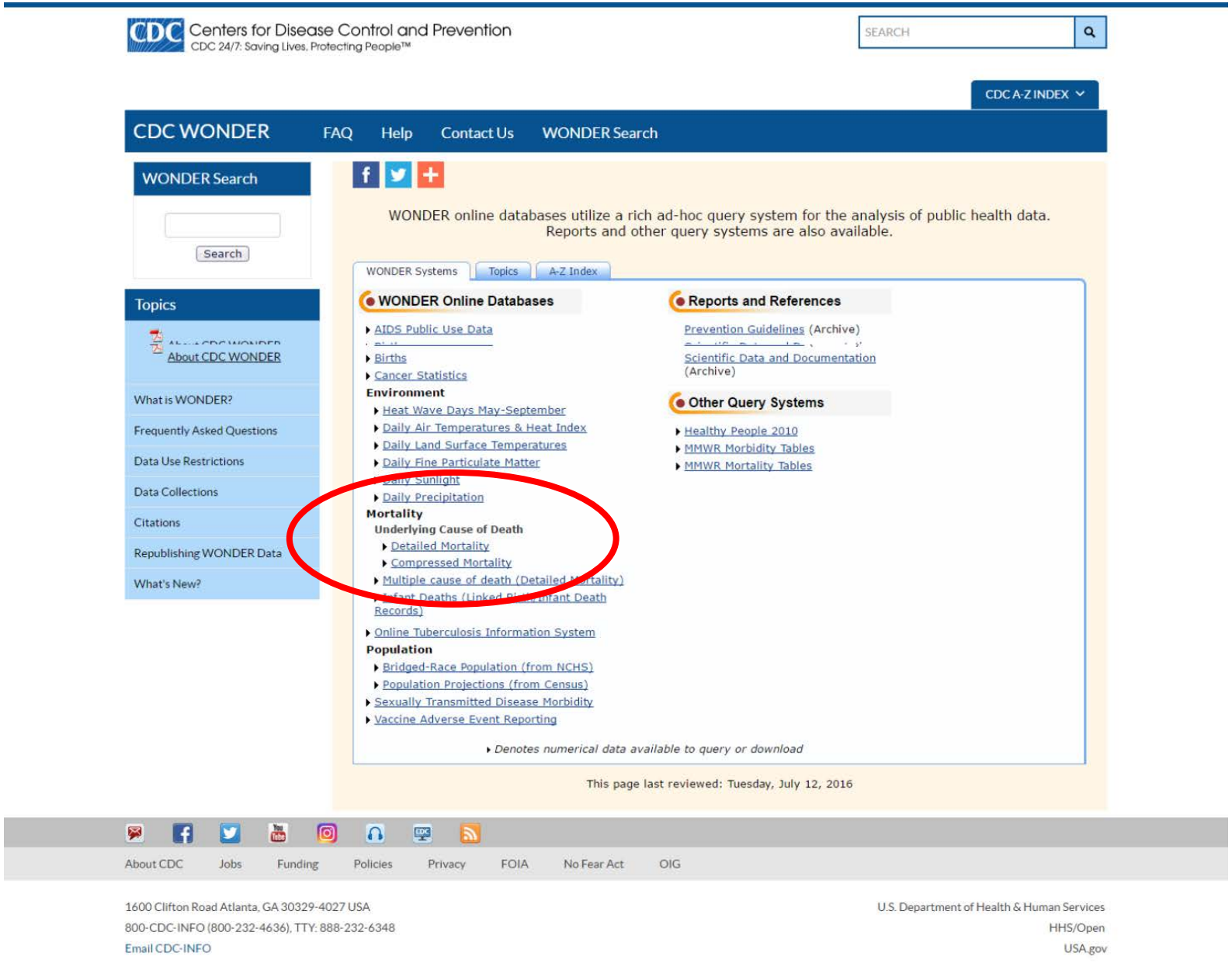
Sources: OECD Health Data 2015; ^California Maternal Quality Care Collaborative (CMQCC) 2014; NCHS. 2009. *Deaths, Final Data, 2007*.

NOTE: 2008-2013 US rates unofficial^

Where CMQCC got their data – CDC Wonder



Underlying cause of death

Total maternal deaths (during pregnancy or within 42 days after the end of pregnancy) (A34, O00-O95, O98-O99)

Total direct obstetric causes (A34, O00-O92)

Pregnancy with abortive outcome (O00-O07)

Ectopic pregnancy (O00)

Hypertensive disorders (O10-O16)

Pre-existing hypertension (O10)

Eclampsia and pre-eclampsia (O11,O13-O16)

Obstetric Hemorrhage (O20,O43.2,O44-O46,O67,O71.0-O71.1, O71.3-O71.4,O71.7,O72)

Pregnancy-related infection (O23,O41.1,O75.3,O85,O86,O91)

Puerperal sepsis (O85)

Other obstetric complications (O21-O22,O24-O28,O30-O41.0, O41.8-O43.1, O43.8-O43.9,O47--O66,O68-O70,O71.2, O71.5, O71.6, O71.8, O71.9,O73,O75.0-O75.2,O75.4-O75.9,O87-O90,O92)

Diabetes mellitus in pregnancy (O24)

Liver disorders in pregnancy (O26.6)

Other specified pregnancy-related conditions (O26.8)

Obstetric embolism (O88)

Cardiomyopathy in the puerperium (O90.3)

Anesthesia-related complications (O29,O74,O89)

Total indirect causes (O98-O99)

Mental disorders and diseases of the nervous system (O99.3)

Diseases of the circulatory system (O99.4)

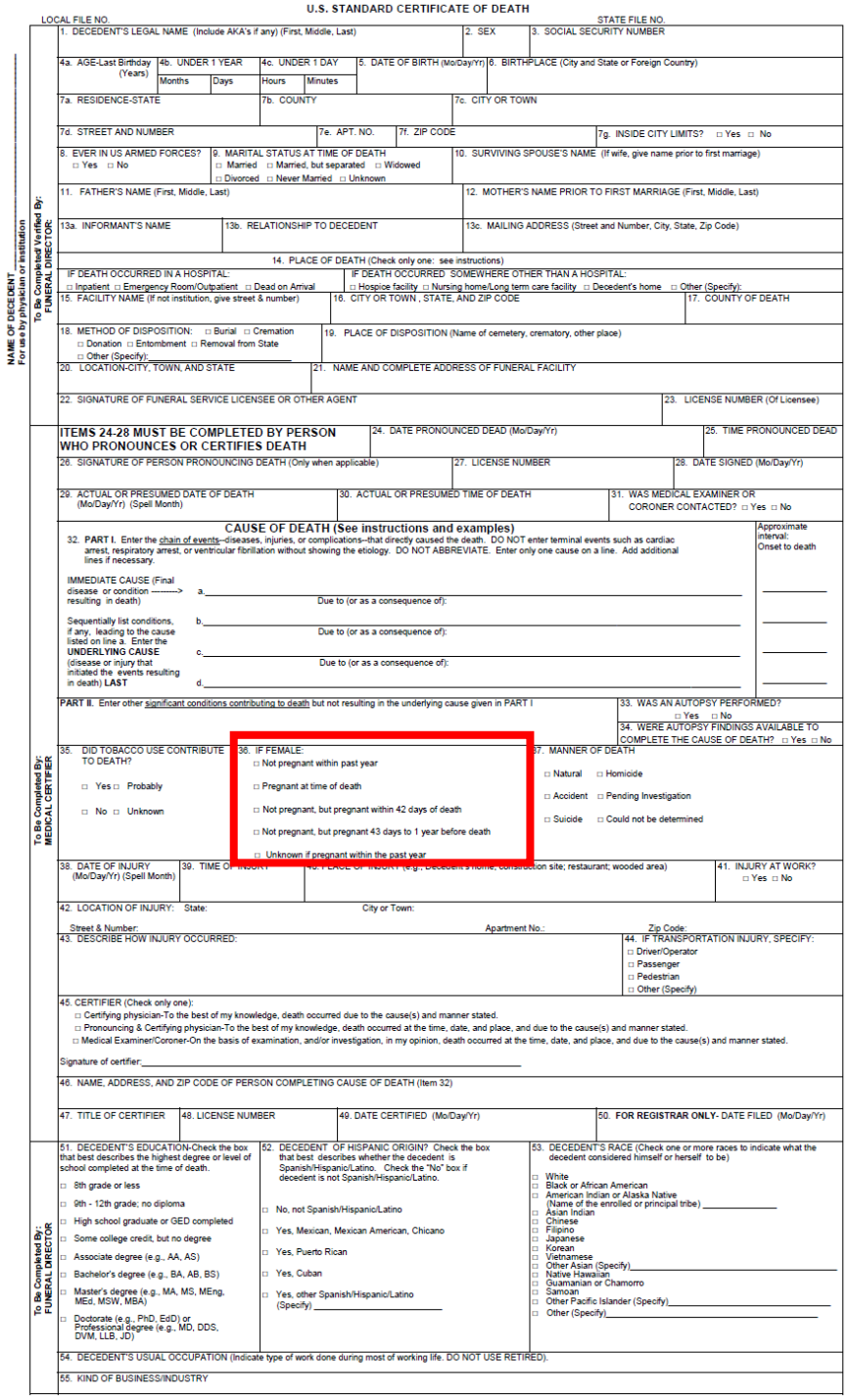
Diseases of the respiratory system (O99.5)

Other specified diseases and conditions (O99.8)

Obstetric death of unspecified cause (O95)

Late maternal causes (43 days-1 year after the end of pregnancy) (O96-O97)

Maternal Death ICD-10 Codes



U.S. STANDARD CERTIFICATE OF DEATH

LOCAL FILE NO. STATE FILE NO.

NAME OF DECEDENT
For use by physician or institution
To Be Completed Verified By: FUNERAL DIRECTOR:

1. DECEDENT'S LEGAL NAME (Include AKA's if any) (First, Middle, Last) | 2. SEX | 3. SOCIAL SECURITY NUMBER

4a. AGE-Last Birthday (Years) | 4b. UNDER 1 YEAR Months Days | 4c. UNDER 1 DAY Hours Minutes | 5. DATE OF BIRTH (Mo/Day/Yr) | 6. BIRTHPLACE (City and State or Foreign Country)

7a. RESIDENCE-STATE | 7b. COUNTY | 7c. CITY OR TOWN

7d. STREET AND NUMBER | 7e. APT. NO. | 7f. ZIP CODE | 7g. INSIDE CITY LIMITS? □ Yes □ No

8. EVER IN US ARMED FORCES? □ Yes □ No | 9. MARITAL STATUS AT TIME OF DEATH □ Married □ Married, but separated □ Widowed □ Divorced □ Never Married □ Unknown | 10. SURVIVING SPOUSE'S NAME (If wife, give name prior to first marriage)

11. FATHER'S NAME (First, Middle, Last) | 12. MOTHER'S NAME PRIOR TO FIRST MARRIAGE (First, Middle, Last)

13a. INFORMANT'S NAME | 13b. RELATIONSHIP TO DECEDENT | 13c. MAILING ADDRESS (Street and Number, City, State, Zip Code)

14. PLACE OF DEATH (Check only one: see instructions)

IF DEATH OCCURRED IN A HOSPITAL: □ Inpatient □ Emergency Room/Outpatient □ Dead on Arrival
IF DEATH OCCURRED SOMEWHERE OTHER THAN A HOSPITAL: □ Hospice facility □ Nursing home/Long term care facility □ Decedent's home □ Other (Specify):

15. FACILITY NAME (If not institution, give street & number) | 16. CITY OR TOWN, STATE, AND ZIP CODE | 17. COUNTY OF DEATH

18. METHOD OF DISPOSITION: □ Burial □ Cremation □ Donation □ Entombment □ Removal from State □ Other (Specify): | 19. PLACE OF DISPOSITION (Name of cemetery, crematory, other place)

20. LOCATION-CITY, TOWN, AND STATE | 21. NAME AND COMPLETE ADDRESS OF FUNERAL FACILITY

22. SIGNATURE OF FUNERAL SERVICE LICENSEE OR OTHER AGENT | 23. LICENSE NUMBER (Of Licensee)

To Be Completed By: MEDICAL CERTIFIER

ITEMS 24-28 MUST BE COMPLETED BY PERSON WHO PRONOUNCES OR CERTIFIES DEATH | 24. DATE PRONOUNCED DEAD (Mo/Day/Yr) | 25. TIME PRONOUNCED DEAD

26. SIGNATURE OF PERSON PRONOUNCING DEATH (Only when applicable) | 27. LICENSE NUMBER | 28. DATE SIGNED (Mo/Day/Yr)

29. ACTUAL OR PRESUMED DATE OF DEATH (Mo/Day/Yr) (Spell Month) | 30. ACTUAL OR PRESUMED TIME OF DEATH | 31. WAS MEDICAL EXAMINER OR CORONER CONTACTED? □ Yes □ No

CAUSE OF DEATH (See instructions and examples)

32. PART I. Enter the chain of events--diseases, injuries, or complications--that directly caused the death. DO NOT enter terminal events such as cardiac arrest, respiratory arrest, or ventricular fibrillation without showing the etiology. DO NOT ABBREVIATE. Enter only one cause on a line. Add additional lines if necessary.

Approximate interval: Onset to death

IMMEDIATE CAUSE (Final disease or condition ——> resulting in death) a. ____ Due to (or as a consequence of):

Sequentially list conditions, if any, leading to the cause listed on line a. Enter the UNDERLYING CAUSE (disease or injury that initiated the events resulting in death) LAST
b. ____ Due to (or as a consequence of):
c. ____ Due to (or as a consequence of):
d. ____

PART II. Enter other significant conditions contributing to death but not resulting in the underlying cause given in PART I | 33. WAS AN AUTOPSY PERFORMED? □ Yes □ No | 34. WERE AUTOPSY FINDINGS AVAILABLE TO COMPLETE THE CAUSE OF DEATH? □ Yes □ No

35. DID TOBACCO USE CONTRIBUTE TO DEATH? □ Yes □ Probably □ No □ Unknown

36. IF FEMALE: □ Not pregnant within past year □ Pregnant at time of death □ Not pregnant, but pregnant within 42 days of death □ Not pregnant, but pregnant 43 days to 1 year before death □ Unknown if pregnant within the past year

37. MANNER OF DEATH □ Natural □ Homicide □ Accident □ Pending Investigation □ Suicide □ Could not be determined

38. DATE OF INJURY (Mo/Day/Yr) (Spell Month) | 39. TIME OF INJURY | 40. PLACE OF INJURY (e.g., Decedent's home; construction site; restaurant; wooded area) | 41. INJURY AT WORK? □ Yes □ No

42. LOCATION OF INJURY: State: City or Town: Street & Number: Apartment No.: Zip Code:

43. DESCRIBE HOW INJURY OCCURRED: | 44. IF TRANSPORTATION INJURY, SPECIFY: □ Driver/Operator □ Passenger □ Pedestrian □ Other (Specify)

45. CERTIFIER (Check only one):
□ Certifying physician-To the best of my knowledge, death occurred due to the cause(s) and manner stated.
□ Pronouncing & Certifying physician-To the best of my knowledge, death occurred at the time, date, and place, and due to the cause(s) and manner stated.
□ Medical Examiner/Coroner-On the basis of examination, and/or investigation, in my opinion, death occurred at the time, date, and place, and due to the cause(s) and manner stated.

Signature of certifier:

46. NAME, ADDRESS, AND ZIP CODE OF PERSON COMPLETING CAUSE OF DEATH (Item 32)

47. TITLE OF CERTIFIER | 48. LICENSE NUMBER | 49. DATE CERTIFIED (Mo/Day/Yr) | 50. FOR REGISTRAR ONLY- DATE FILED (Mo/Day/Yr)

To Be Completed By: FUNERAL DIRECTOR

51. DECEDENT'S EDUCATION-Check the box that best describes the highest degree or level of school completed at the time of death.
□ 8th grade or less
□ 9th - 12th grade; no diploma
□ High school graduate or GED completed
□ Some college credit, but no degree
□ Associate degree (e.g., AA, AS)
□ Bachelor's degree (e.g., BA, AB, BS)
□ Master's degree (e.g., MA, MS, MEng, MEd, MSW, MBA)
□ Doctorate (e.g., PhD, EdD) or Professional degree (e.g., MD, DDS, DVM, LLB, JD)

52. DECEDENT OF HISPANIC ORIGIN? Check the box that best describes whether the decedent is Spanish/Hispanic/Latino. Check the "No" box if decedent is not Spanish/Hispanic/Latino.
□ No, not Spanish/Hispanic/Latino
□ Yes, Mexican, Mexican American, Chicano
□ Yes, Puerto Rican
□ Yes, Cuban
□ Yes, other Spanish/Hispanic/Latino (Specify) ____

53. DECEDENT'S RACE (Check one or more races to indicate what the decedent considered himself or herself to be)
□ White
□ Black or African American
□ American Indian or Alaska Native (Name of the enrolled or principal tribe) ____
□ Asian Indian
□ Chinese
□ Filipino
□ Japanese
□ Korean
□ Vietnamese
□ Other Asian (Specify) ____
□ Native Hawaiian
□ Guamanian or Chamorro
□ Samoan
□ Other Pacific Islander (Specify) ____
□ Other (Specify) ____

54. DECEDENT'S USUAL OCCUPATION (Indicate type of work done during most of working life. DO NOT USE RETIRED).

55. KIND OF BUSINESS/INDUSTRY

Revised (2003) U.S. Standard Certificate of Death

PART II (Other significant conditions)

•Enter all diseases or conditions contributing to death that were not reported in the chain of events in Part I and that did not result in the **underlying cause of death**. See attached examples.
•If two or more possible sequences resulted in death, or if two conditions seem to have added together, report in Part I the one that, in your opinion, most directly caused death. Report in Part II the other conditions or diseases.

CHANGES TO CAUSE OF DEATH

Should additional medical information or autopsy findings become available that would change the cause of death originally reported, the original death certificate should be amended by the certifying physician by **immediately** reporting the revised cause of death to the State Vital Records Office.

ITEMS 33-34 - AUTOPSY

•33 - Enter "Yes" if either a partial or full autopsy was performed. Otherwise enter "No."
•34 - Enter "Yes" if autopsy findings were available to complete the cause of death; otherwise enter "No". Leave item blank if no autopsy was performed.

ITEM 35 - DID TOBACCO USE CONTRIBUTE TO DEATH?

Check "yes" if, in your opinion, the use of tobacco contributed to death. Tobacco use may contribute to deaths due to a wide variety of diseases; for example, tobacco use contributes to many deaths due to emphysema or lung cancer and some heart disease and cancers of the head and neck. Check "no" if, in your clinical judgment, tobacco use did not contribute to this particular death.

ITEM 36 - IF FEMALE, WAS DECEDENT PREGNANT AT TIME OF DEATH OR WITHIN PAST YEAR?

This information is important in determining pregnancy-related mortality.

ITEM 37 - MANNER OF DEATH

•Always check Manner of Death, which is important: 1) in determining accurate causes of death; 2) in processing insurance claims; and 3) in statistical studies of injuries and death.
•Indicate "Pending investigation" if the manner of death cannot be determined whether due to an accident, suicide, or homicide within the statutory time limit for filing the death certificate. This should be changed later to one of the other terms.
•Indicate "Could not be Determined" **ONLY** when it is impossible to determine the manner of death.

To improve case identification:

U.S. Standard Pregnancy Question, 2003 (sort of)

Checkbox format:

IF FEMALE:

- ❑ Not pregnant within past year
- ❑ Pregnant at time of death
- ❑ Not pregnant, but pregnant within 42 days of death
- ❑ Not pregnant, but pregnant 43 days to 1 year before death
- ❑ Unknown if pregnant within the past year

Meant to solve 2 problems:

(1) Most states had no such question; and

(2) Different questions used in different states

The Check Box

Determining Pregnancy Status to Improve Maternal Mortality Surveillance

Andrea P. MacKay, MSPH, Roger Rochat, MD, Jack C. Smith, MS, Cynthia J. Berg, MD, MPH

Objective: More than half of pregnancy-related deaths are not identified through routine surveillance methods. The purpose of this study was to evaluate the effectiveness of the pregnancy check box on death certificates in ascertaining pregnancy-related deaths.

Methods: Data derived from the Centers for Disease Control and Prevention's ongoing Pregnancy Mortality Surveillance System were used to identify states that included a check box on the death certificate in 1991 and 1992. Death certificates from those states were evaluated to determine the number and proportion of pregnancy-related deaths identified by a marked check box. Characteristics of death were also examined.

Results: Sixteen states and New York City included a check box or question specifically asking about pregnancy of the decedent. Of the 425 pregnancy-related deaths identified in the 17 reporting areas, 124 (29%) were determined to be pregnancy-related deaths only because of the pregnancy status information provided in the check box. The proportion of deaths identified only by a marked check box ranged from less than 5% for four states to 40% or more for seven states.

Conclusions: The availability of pregnancy status information on death certificates is a simple and effective aid in ascertaining a pregnancy-related death, when no other indicators of pregnancy appear on the death certificate. Routine use of the pregnancy check box for all states would lead to substantially increased classification of maternal deaths and more accurate classification of the causes of and risk factors for maternal deaths.

16 States already had a checkbox as far back as 1991-1992, but with different wording

Am J Prev Med 2000;19(1S):35-39.

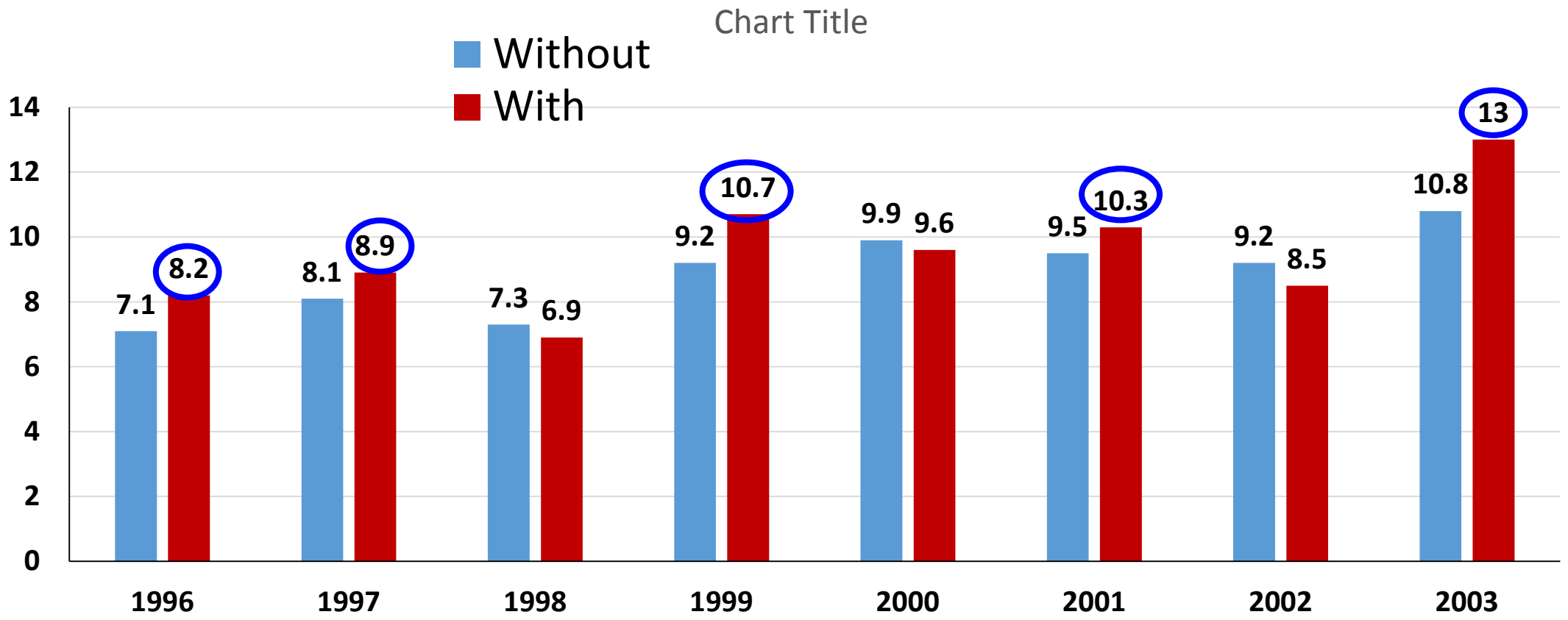
Table III. Separate questions related to pregnancy on state certificates in 2003

Alabama	Was there a pregnancy in last 42 days? (Specify Yes, No, or Unknown)
California	If female, pregnant in last year? ☐ Yes ☐ No ☐ Unknown
Florida	If female, was there a pregnancy in the past 3 months? ___ Yes ___ No
Idaho	If female aged 10–54: ☐ not pregnant within past year ☐ pregnant at time of death ☐ not pregnant, but pregnant within 42 days of death ☐ not pregnant, but pregnant 43 days to 1 year before death ☐ unknown if pregnant within the past year
Illinois	If female, was there a pregnancy in past three months? ☐ Yes ☐ No
Indiana	Was decedent pregnant or 90 days postpartum? (Yes or no)
Iowa	If female, was there a pregnancy in the past 12 months? (Specify yes or no)
Kentucky	If female, was there a pregnancy in the past 12 months? ☐ Yes ☐ No
Louisiana	If deceased was female 10–49, was she pregnant in the last 90 days? ☐ Yes ☐ No ☐ Unknown
Maryland	If female: Was decedent pregnant in the past 12 months? ☐ Yes ☐ No ☐ Unknown *Separate fields on dates of death and delivery support capability to compute the other categories in the standard.*
Minnesota	Was female pregnant: At death? ___ yes ___ no ___ unknown In last 12 months? ___ yes ___ no ___ unknown
Mississippi	Had decedent been pregnant within 90 days prior to death? ☐ Yes ☐ No
Missouri	If deceased was female 10–49, was she pregnant in the last 90 days? ☐ Yes ☐ No ☐ Unknown
Montana	If female: ☐ not pregnant within past year ☐ not pregnant but pregnant with 42 days of death ☐ not pregnant but pregnant 43 days to 1 year before death ☐ pregnant at time of death ☐ unknown if pregnant within past year
Nebraska	If female, was there a pregnancy in the past 3 months? ☐ Yes ☐ No
New Jersey	If female, was she pregnant at death, or any time 90 days prior to death? ☐ Yes ☐ No
New Mexico	Was decedent pregnant within last 6 weeks? ☐ Yes ☐ No
New York City	If female: ☐ not pregnant within 1 year of death ☐ pregnant at time of death ☐ not pregnant at death, but pregnant within 42 days of death ☐ not pregnant at death, but pregnant 43 days to 1 year before death ☐ unknown if pregnant within 1 year of death *Also have date of outcome, so could compute intervals if needed.*
New York State	If female: ☐ not pregnant within last year ☐ pregnant at time of death ☐ not pregnant, but pregnant within 42 days of death ☐ not pregnant, but pregnant 43 days to 1 year before death ☐ unknown if pregnant within past year *Also have date of delivery, so could compute intervals if needed.*
North Dakota	Was deceased pregnant within 18 months of death? ☐ Yes ☐ No
Texas	Was decedent pregnant at time of death ☐ Yes ☐ No ☐ Unknown within last 12 months ☐ Yes ☐ No ☐ Unknown
Virginia	If female, was there a pregnancy in past 3 months? ☐ Yes ☐ No ☐ Unknown

Time periods used:
42 days;
6 weeks;
3 months;
90 days;
12 mos;
“last year”

[redacted]

Maternal Mortality Rates (per 100,000) in States with & without a checkbox, 1996-2003



So adopting the checkbox will solve the problem of under ascertainment & we can report a more accurate national rate after 2003?

Source: Hoyert DL. *Maternal mortality and related concepts*. National Center for Health Statistics. Vital Health Stat 3(33). 2007.

Delays in Adoption of the U.S. Standard Pregnancy Question among States

	New Adopters*	Total
2003	4	4
2004	7	11
2005	7	18
2006	4	22
2007	2	24
2008	7	31
2009	0	31
2010	4	35
2011	2	37
2012	4	41
2013	1	42
2014	5	47
2015	2	49
2016	1	50
2017	1	51

New England	
New Hampshire	4/2004
Connecticut	2005
Rhode Island	2006
Vermont	7/2008
Maine	2010
Massachusetts	**9/2014**

* Note: Some states adopted change in the middle of the calendar year.

Our Analysis

We did an analysis that examined data by state, modeled for whether or not they were using the new item, and came up with national estimates.

Not enough cases to do single state analyses, but could look at some of the larger states.

Original Research

Recent Increases in the U.S. Maternal Mortality Rate

Disentangling Trends From Measurement Issues

Marian F. MacDorman, PhD, Eugene Declercq, PhD, Howard Cabral, PhD, and Christine Morton, PhD

RESULTS: The estimated maternal mortality rate (per 100,000 live births) for 48 states and Washington, DC (excluding California and Texas, analyzed separately) increased by 26.6%, from 18.8 in 2000 to 23.8 in 2014. California showed a declining trend, whereas Texas had a sudden increase in 2011–2012. Analysis of the measurement change suggests that U.S. rates in the early 2000s were higher than previously reported.

Grouping the States

- **Group 1** – **24 states** & D.C. that ***did not have an unrevised pregnancy question*** and adopted the U. S. standard question by January 2013

- **Group 2** – **14 states** that ***had an unrevised pregnancy question with a timeframe longer*** than the U.S. standard

- **Group 3** – **7 states** that ***had not revised by late 2013*** with either no pregnancy question or a nonstandard pregnancy question on their unrevised death certificate.

- **Group 4** – **3 states** that ***had an unrevised pregnancy question consistent with the U.S. standard.***

But wait – that only adds up to 48 states & DC

Grouping the States

- **Group 1** – 24 states & D.C. that ***did not have an unrevised pregnancy question*** and adopted the U. S. standard question by January 2013

- **Group 2** – 14 states that ***had an unrevised pregnancy question with a timeframe longer*** than the U.S. standard

- **Group 3** – 7 states that ***had not revised by late 2013*** with either no pregnancy question or a nonstandard pregnancy question on their unrevised death certificate.

- **Group 4** – 3 states that ***had an unrevised pregnancy question consistent with the U.S. standard***.

California and Texas are unique – each in their own ways

Correcting for Impact of Adding Pregnancy Box

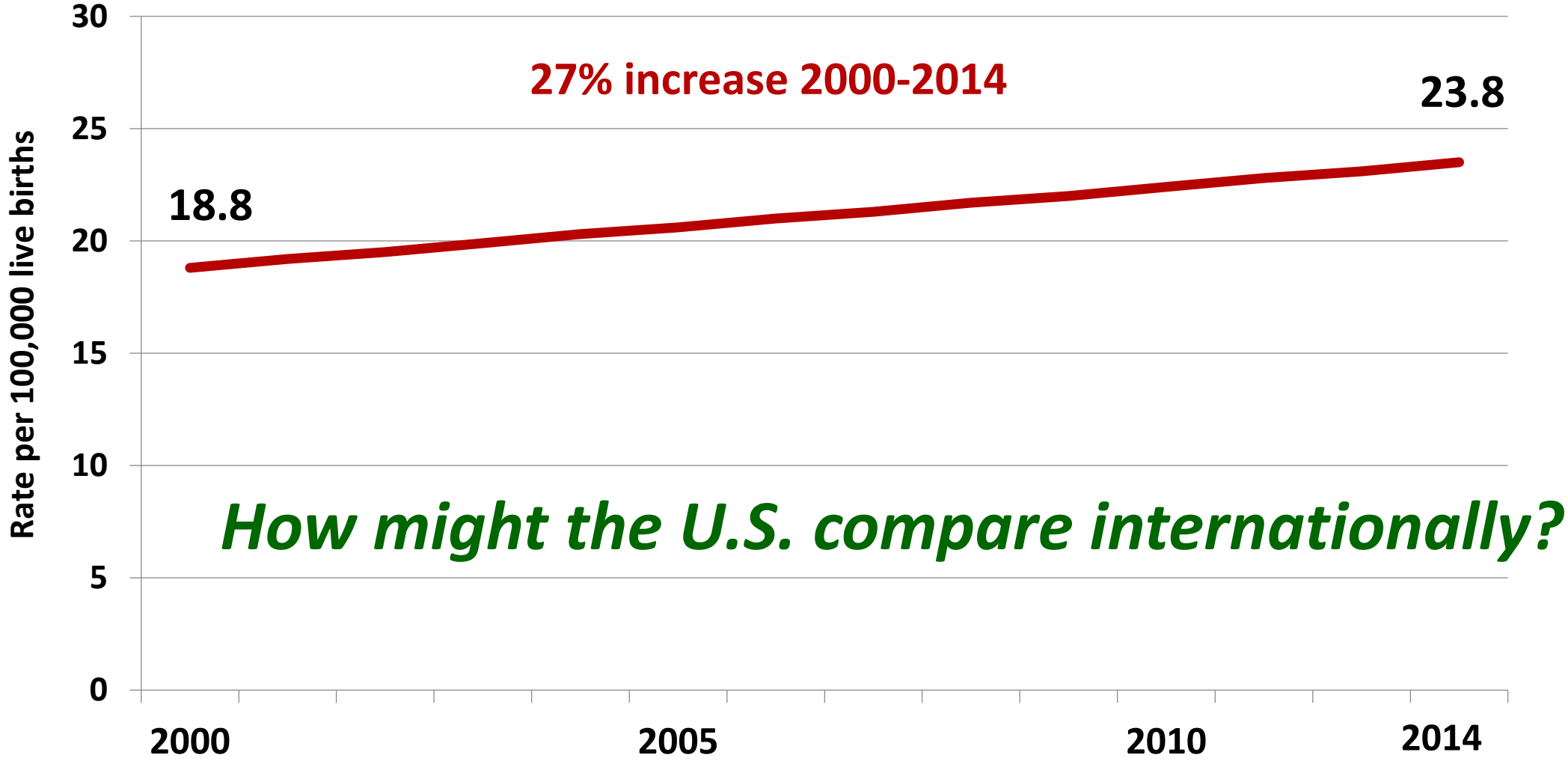
$$\text{Correction factor} = \frac{\text{Sum of the number of maternal deaths in each state for 2 years following the revision date}}{\text{Sum of the number of maternal deaths in each state for the 2 years preceding the revision date}}$$

Also did tests involving 1 year and 3 year periods with little change

Estimating a Combined, Adjusted MMR, for 48 states and DC, from 2000-2014

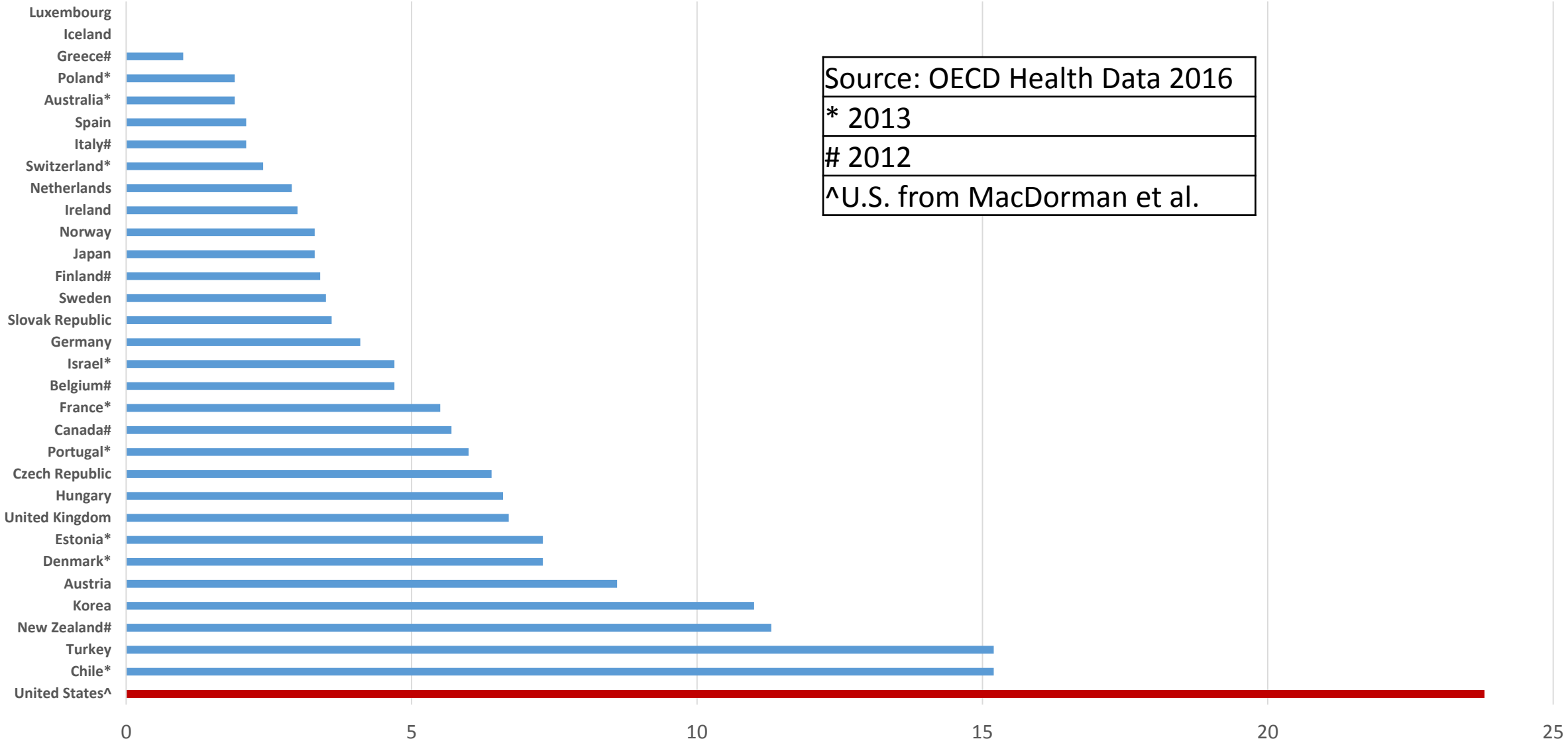
- California excluded because only reports deaths at <1 year. Texas excluded because of divergent trend.
- First, computed the weighted average of the slopes of the regression lines from Analysis Groups 1-4, weighted by the total number of live births in each group from 2000-2014. Weighted slope=0.357.
- Then computed a combined 2014 MMR for the 44 states and DC with standard pregnancy question.
- Used the combined slope to back-estimate MMRs back to 2000.

Estimated MMRs, 48 states* and DC, 2000-2014



*Excludes California and Texas.

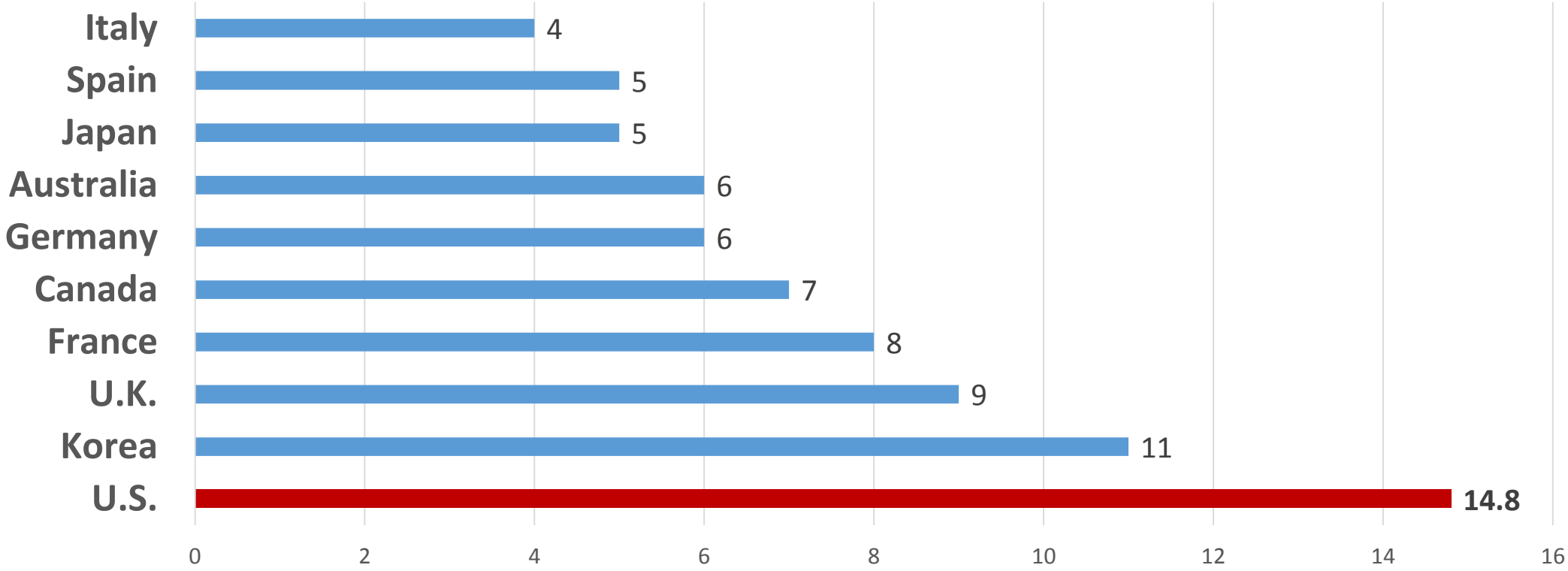
Maternal Mortality Ratios, OECD* Countries, 2014



Source: OECD Health Data 2016
* 2013
# 2012
^U.S. from MacDorman et al.

* Organization for Economic and Cooperation and Development

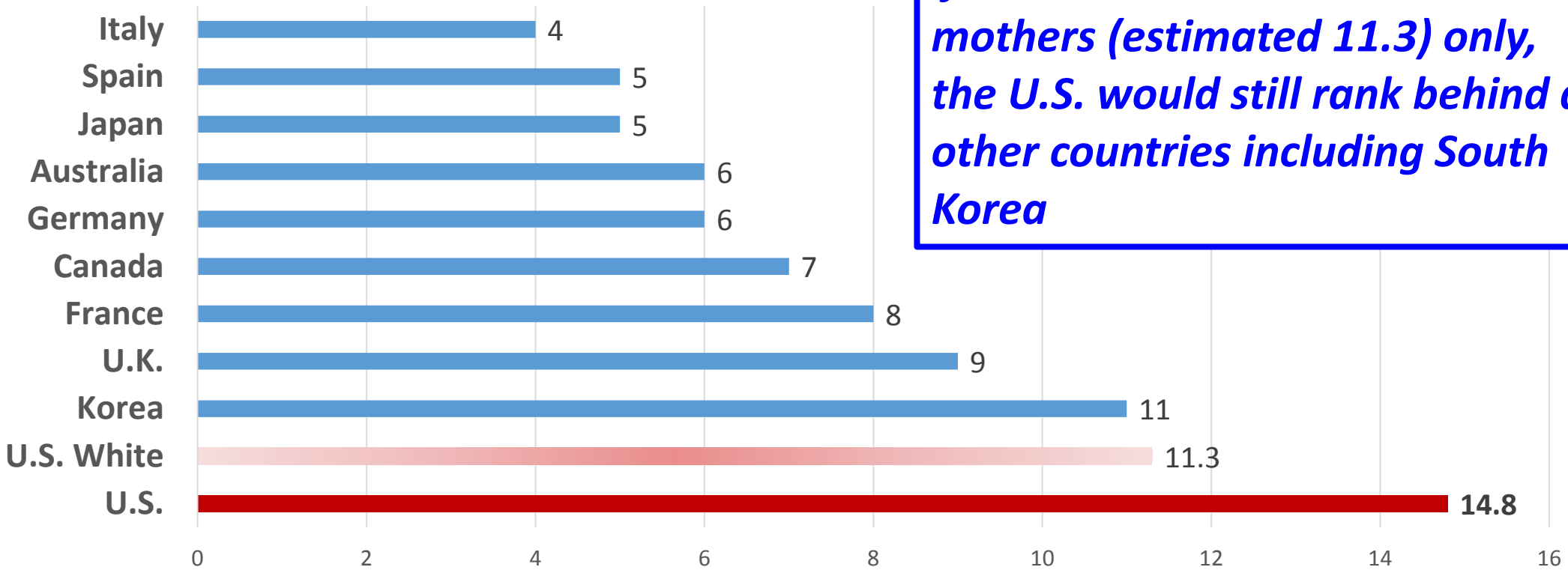
U.S. MMR* Compared to Countries with 300,000+ births, 2014, using WHO Estimates



* Maternal Mortality per 100,000 births

Source: *Maternal Mortality: 1990 to 2015* Estimates by WHO, UNICEF, UNFPA, World Bank Group & UN Population Division. Geneva: 2015.

U.S. MMR* Compared to Countries with 300,000+ births, 2014, using WHO Estimates



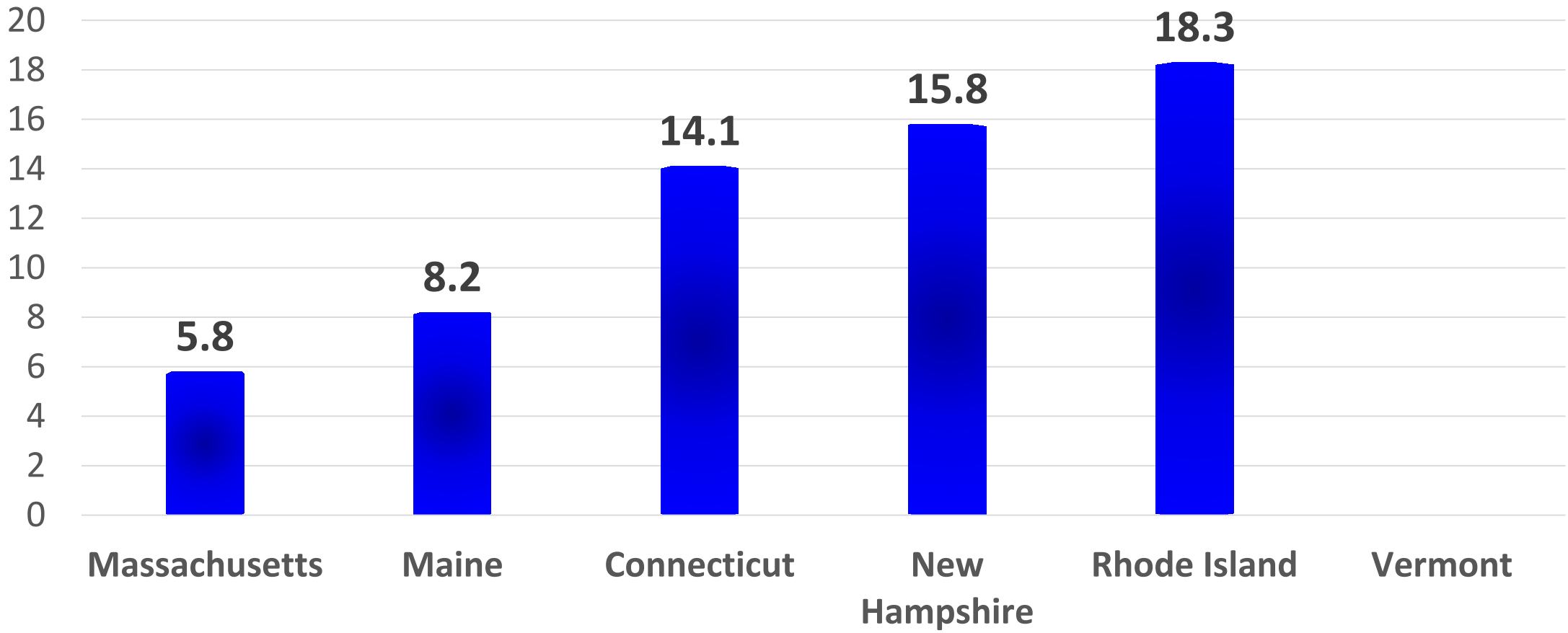
If we limited the US ratio to white mothers (estimated 11.3) only, the U.S. would still rank behind all other countries including South Korea

* Maternal Mortality per 100,000 births

Source: *Maternal Mortality: 1990 to 2015* Estimates by WHO, UNICEF, UNFPA, World Bank Group & UN Population Division. Geneva: 2015.

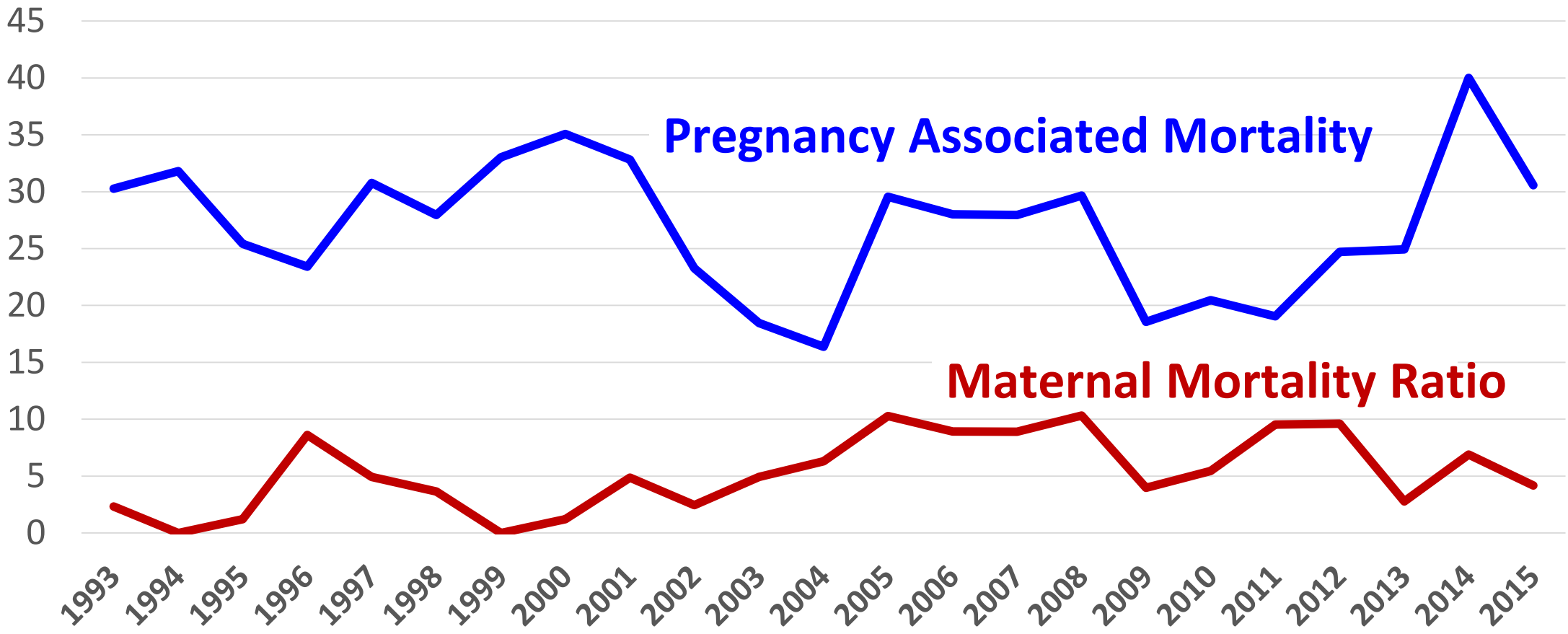
But what about me?
How are we doing locally?

Maternal Mortality Ratio (per 100,000 live births) in New England States, 2016 (?)



Source: America's Health Rankings. United Health Foundation. Their cited source – CDC, National Vital Statistics System
https://www.americashealthrankings.org/explore/2016-health-of-women-and-children-report/measure/maternal_mortality/state/CT/compare/RI

Massachusetts Maternal Deaths, (per 100,000), 1992-2015



Source: Mass DPH

What are the causes of maternal deaths?

Figure 6. Distribution of Pregnancy-Related Deaths Caused by Medical Conditions, Massachusetts, 2000-2007

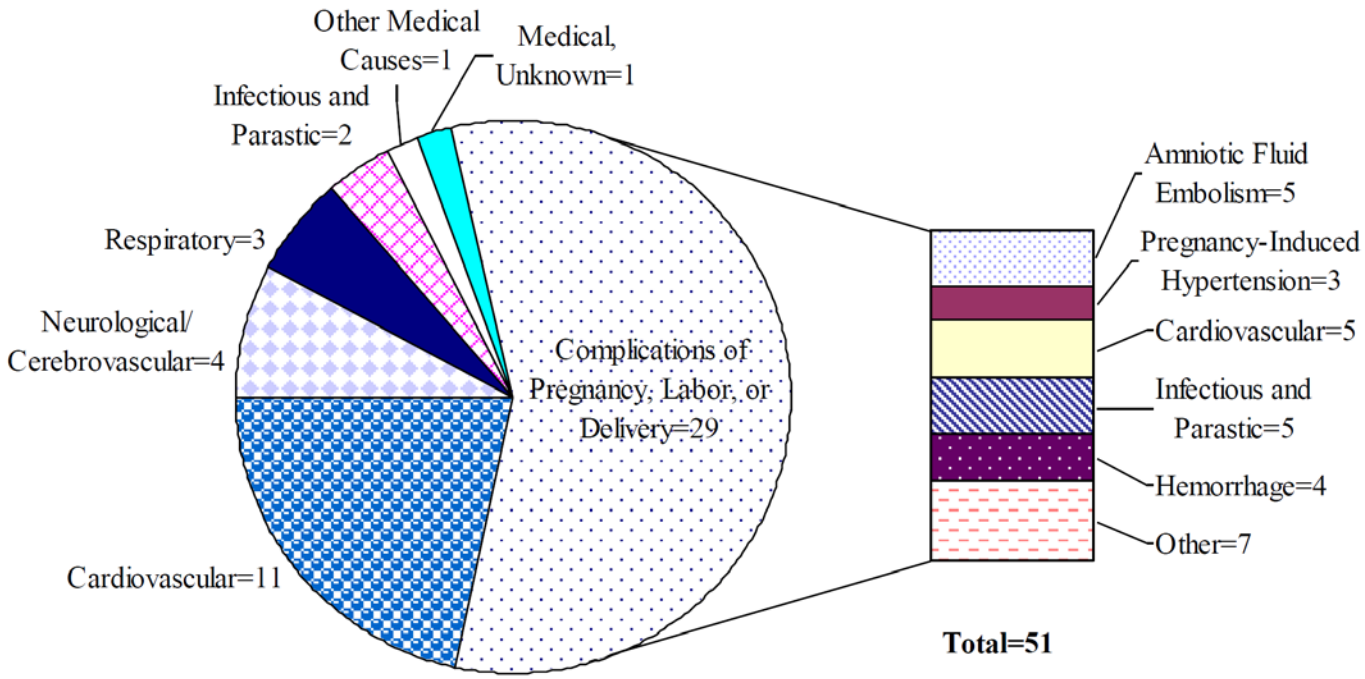
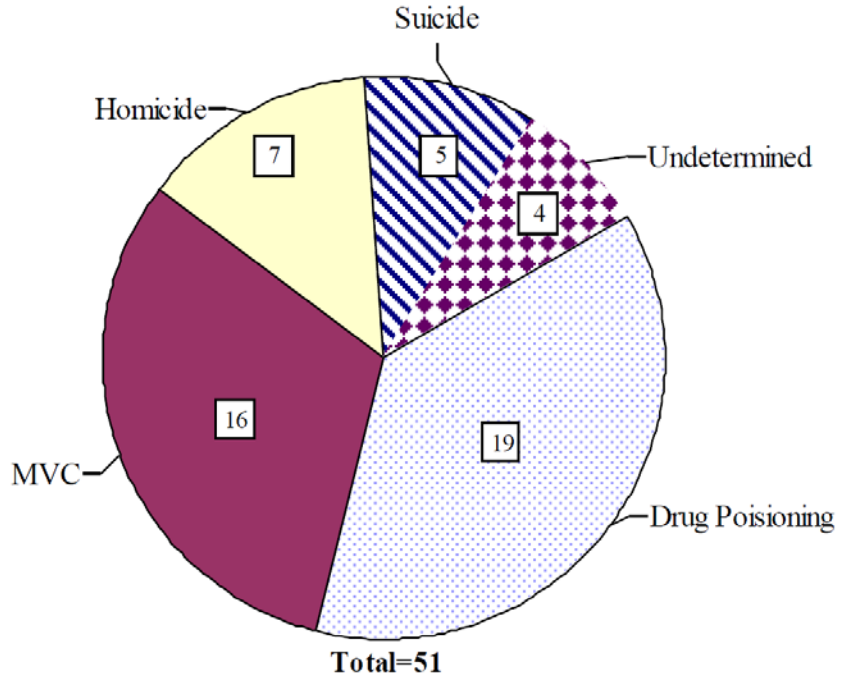


Figure 8. Distribution of Injury Deaths, Massachusetts, 2000-2007



2nd Article in Series

Original Research

Trends in Maternal Mortality by Sociodemographic Characteristics and Cause of Death in 27 States and the District of Columbia

Marian F. MacDorman, PhD, Eugene Declercq, PhD, and Marie E. Thoma, PhD

Obstet Gynecol 2017;129:811–8

Over Ascertainment??

- Research into the cause of death category finds much of the increase is coming from ***less specific codes***.

- Other specified pregnancy-related conditions (O26.8)
- Other obstetric complications (O21–O22, O24– O41.0, O41.8–O43.1, O43.8–O43.9,O47–O66, O68–O70, O71.2, O71.5,O71.6, O71.8, O71.9, O73–O75.2,O75.4–O75.9, O87–O90, O92)
- Other specified diseases and conditions (O99.8)
- Obstetric death of unspecified cause (O95)

Underlying cause of death

Total maternal deaths (during pregnancy or within 42 days after the end of pregnancy) (A34, O00-O95, O98-O99)

Total direct obstetric causes (A34, O00-O92)

Pregnancy with abortive outcome (O00-O07)

Ectopic pregnancy (O00)

Hypertensive disorders (O10-O16)

Pre-existing hypertension (O10)

Eclampsia and pre-eclampsia (O11,O13-O16)

Obstetric Hemorrhage (O20,O43.2,O44-O46,O67,O71.0-O71.1, O71.3-O71.4,O71.7,O72)

Pregnancy-related infection (O23,O41.1,O75.3,O85,O86,O91)

Puerperal sepsis (O85)

Other obstetric complications (O21-O22,O24-O28,O30-O41.0, O41.8-O43.1, O43.8-O43.9,O47--O66,O68-O70,O71.2, O71.5, O71.6, O71.8, O71.9,O73,O75.0-O75.2,O75.4-O75.9,O87-O90,O92)

Diabetes mellitus in pregnancy (O24)

Liver disorders in pregnancy (O26.6)

Other specified pregnancy-related conditions (O26.8)

Obstetric embolism (O88)

Cardiomyopathy in the puerperium (O90.3)

Anesthesia-related complications (O29,O74,O89)

Total indirect causes (O98-O99)

Mental disorders and diseases of the nervous system (O99.3)

Diseases of the circulatory system (O99.4)

Diseases of the respiratory system (O99.5)

Other specified diseases and conditions (O99.8)

Obstetric death of unspecified cause (O95)

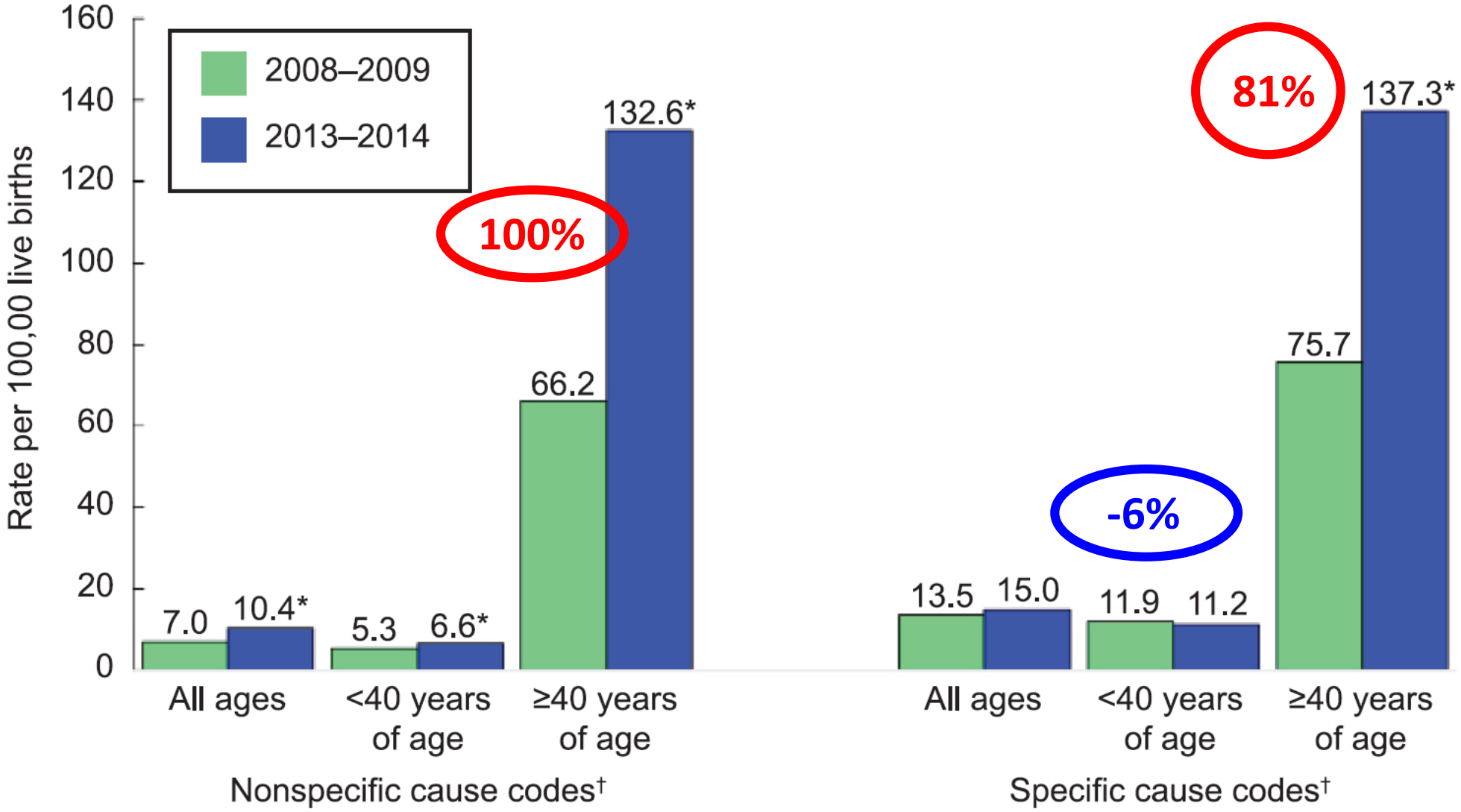
Late maternal causes (43 days-1 year after the end of pregnancy) (O96-O97)

Maternal Death ICD-10 Codes

Assessing the impact of ill-defined causes on maternal deaths and mortality rates by cause of death, 27 states and DC, 2008-2009 to 2013-2014

Underlying cause of death (ICD-10 category)	2008-9 Number of deaths	2008-9 Rate~	2013-14 Number of deaths	2013-14 Rate~	Percent change 2008-9 to 2013-14
Total maternal (A34, O00-O05, O98-O99)	780	20.6	907	25.4	23.3
Ill-defined causes (O26.8, O95, O99.8)	266	7.0	371	10.4	47.9
Total maternal minus ill-defined causes (Remainder)	514	13.5	536	15.0	10.6
Total direct obstetric (A34, O00-O92)	527	13.9	595	16.6	19.7
Other specified pregnancy-related conditions (O26.8)	130	3.4	212	5.9	73.0
Total direct obstetric minus O26.8 (Remainder)	397	10.5	383	10.7	2.3
Total indirect causes (O98-O99)	202	5.3	294	8.2	54.4
Other specified diseases and conditions (O99.8)	85	2.2	141	3.9	75.9
Total indirect causes minus O99.8 (Remainder)	117	3.1	153	4.3	38.7

Maternal mortality rates by age for specific & nonspecific causes of death, 27 states & DC, 2008–2009 and 2013–2014.



Sensitivity Analysis of Impact of 1% Random Miscoding

Age (y)	No. of Maternal Deaths	No. of Female Deaths From Natural Causes (Excludes Maternal Deaths)	No. of Maternal Deaths With 1% False-Positives Added to Total	% Increase in MMR With 1% False-Positive Rate
Total	907	82,572	1,733	91.0
Younger than 40	618	15,553	774	25.2
15–19	26	929	35	35.7
20–24	119	1,619	135	13.6
25–29	152	2,568	178	16.9
30–34	177	4,092	218	23.1
35–39	144	6,345	207	44.1
40–54	289	67,019	959	231.9

REPORT FROM MATERNAL MORTALITY REVIEW COMMITTEES: A VIEW INTO THEIR CRITICAL ROLE

MMRIA
MATERNAL MORTALITY REVIEW INFORMATION APP

BUILDING U.S. CAPACITY TO REVIEW AND PREVENT MATERNAL DEATHS

REVIEW to ACTION
WORKING TOGETHER TO PREVENT MATERNAL MORTALITY

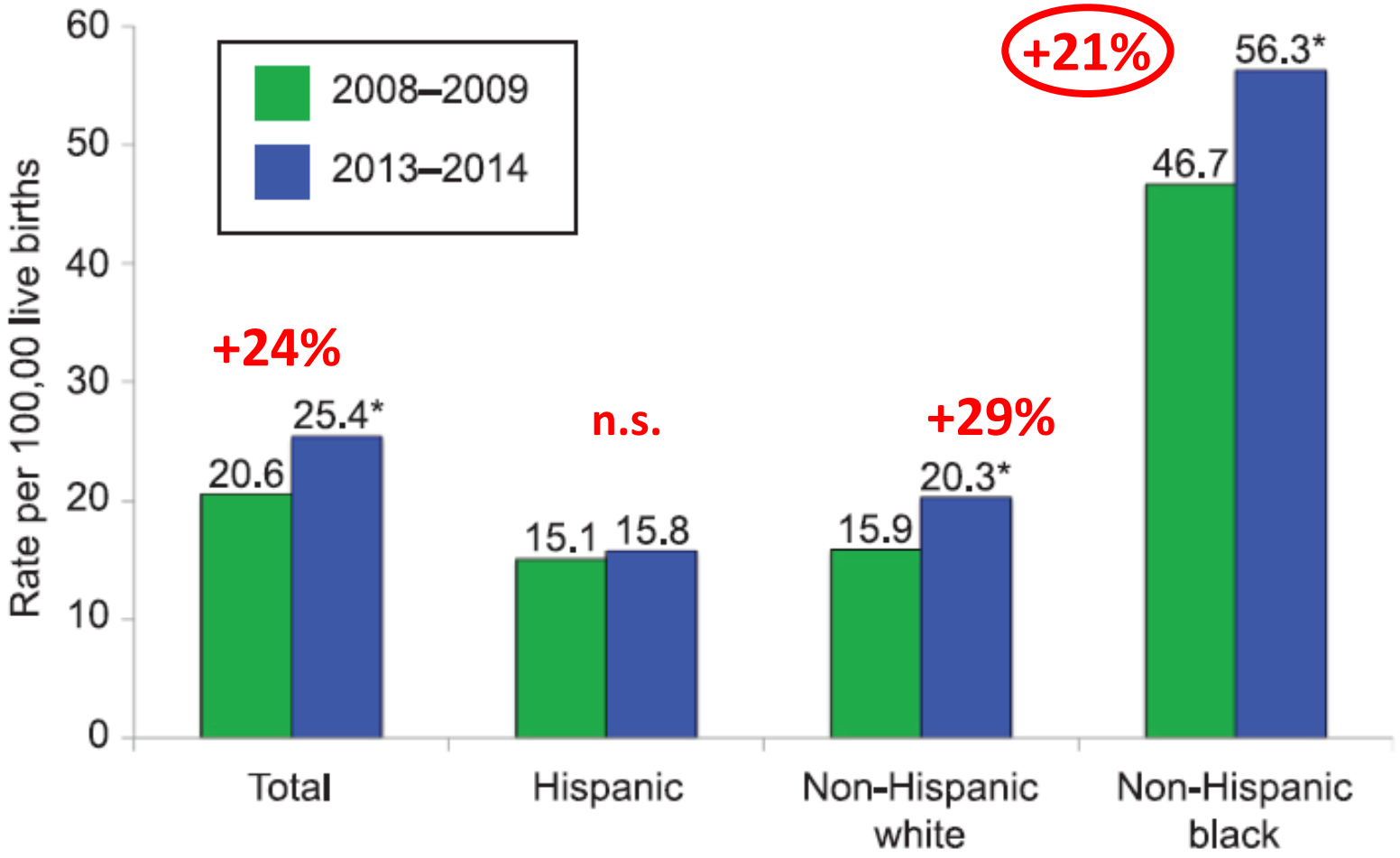
Impact of the Checkbox – Better ***and*** Worse Ascertainment

- The Four Committee data includes a total ***of 650 potentially pregnancy-related deaths. Among these, 97 were determined to have no evidence of pregnancy within the year prior to the woman's death*** (neither pregnancy-related nor –associated; false positive pregnancy-associated deaths), and so were excluded from further analysis. The ***predominant reason for these 97 false positives were errors on the death certificate from the pregnancy checkbox***. While the checkbox contributed to errors, the Four Committee data show that the ***checkbox also improved identification of pregnancy-related deaths***. ***Without the pregnancy checkbox, approximately 50% of pregnancy-related deaths that occurred during pregnancy and 11% of pregnancy-related deaths that occurred within 42 days of the end of pregnancy, and 8% of pregnancy-related deaths that occurred within 43 days to 1 year of the end of pregnancy would have been missed.***

Real potential for over-ascertainment, though unlikely it accounts for the increases which are seen across all settings and even the most conservative measures show the U.S. faring poorly in international comparisons.

How do these findings vary by race/ethnicity?

Maternal mortality rates by race and ethnicity, 27 states* and Washington D.C., 2008-9 and 2013-14



Black-White ratio
2.8

NH = non-Hispanic. n.s. = no significant change.

*** Arkansas, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Kansas, Michigan, Montana Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Utah, Washington, and Wyoming.**

Interracial Differences

Where would estimated rates leave the U.S. in international comparisons?

Hispanic 10.0 (Lithuania 10/Portugal 10)

Interracial Differences

Where would estimated rates leave the U.S. in international comparisons?

Hispanic **10.0 (Lithuania 10/Portugal 10)**

NH White **11.3 (Bulgaria 11/S. Korea 11)**

Interracial Differences

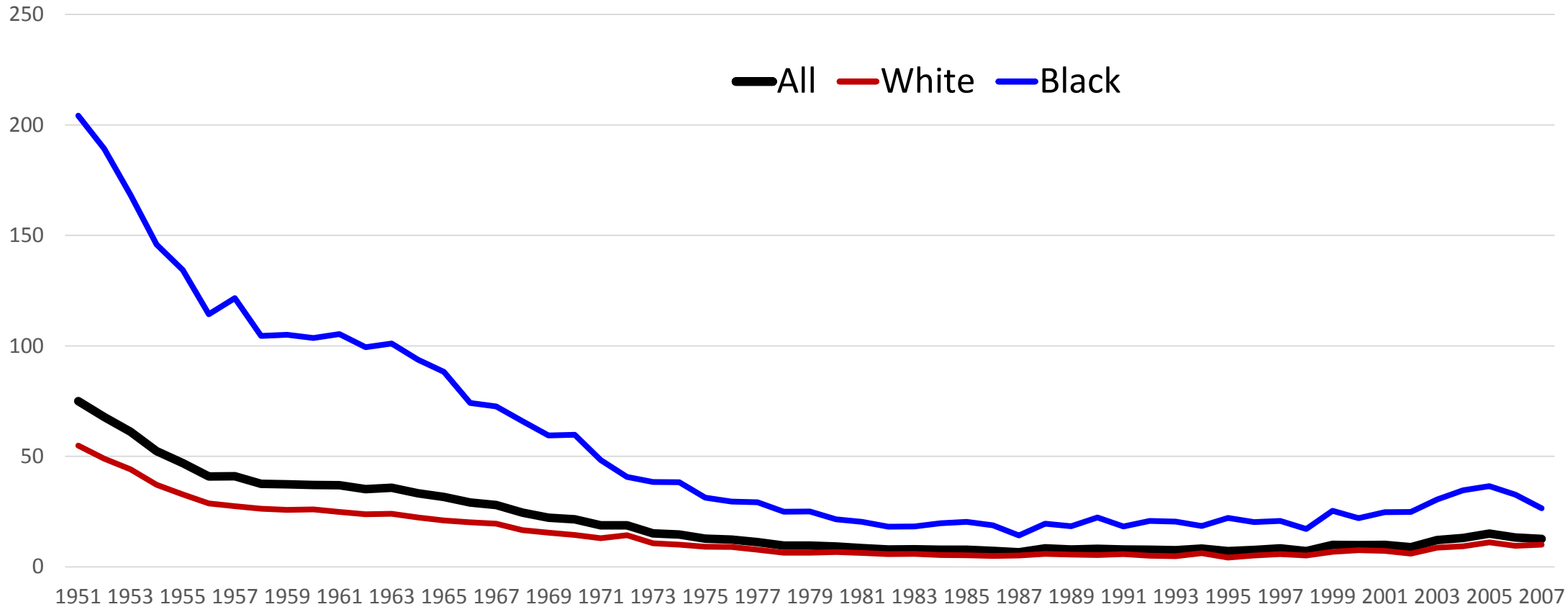
Where would estimated rates leave the U.S. in international comparisons?

Hispanic **10.0 (Lithuania 10/Portugal 10)**

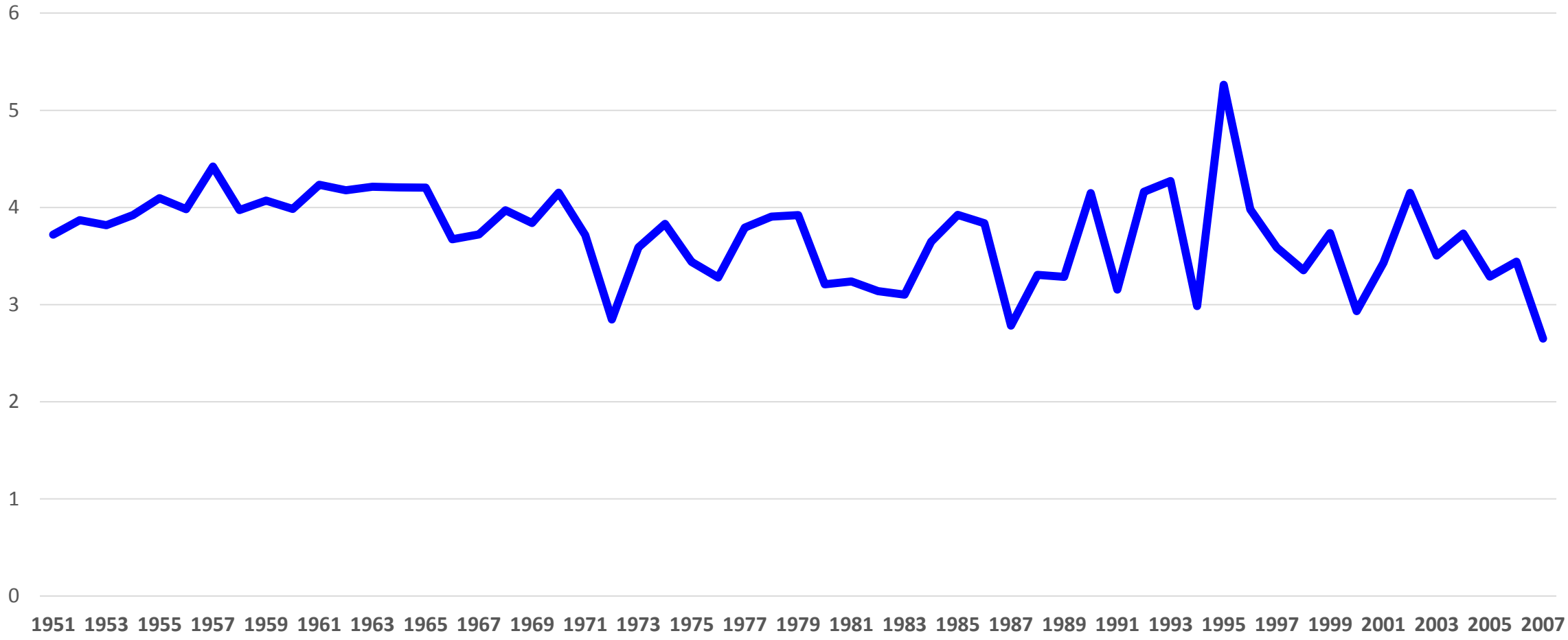
NH White **11.3 (Bulgaria 11/S. Korea 11)**

NH Black **36.2 (Uzbekistan 36/ Mexico 38)**

U.S. Maternal Mortality (per 100,000 live births), 1951-2007 by Race



U.S. Maternal Mortality Ratio of Black to White Rates 1951-2007



Conclusions

- Maternal mortality may be rising at a slower rate than thought, but largely because the earlier rates may have underestimated the actual number of maternal deaths.

- We don’t actually know what the exact national rate is & won’t until we standardize measurement across all states (2018?).

- Maternal deaths in the U.S. by any measure appear to be rising in contrast to most of the rest of the world, resulting in the U.S. ranking declining in international comparisons.

Conclusions

- There are wide disparities by race/ethnicity, HOWEVER, even if we limit comparisons of whites to other countries, the U.S. still fares poorly in international comparisons.

- Deaths for unspecified causes needs more examination, particularly among older mothers

- Texas deserves more attention.

Next Steps

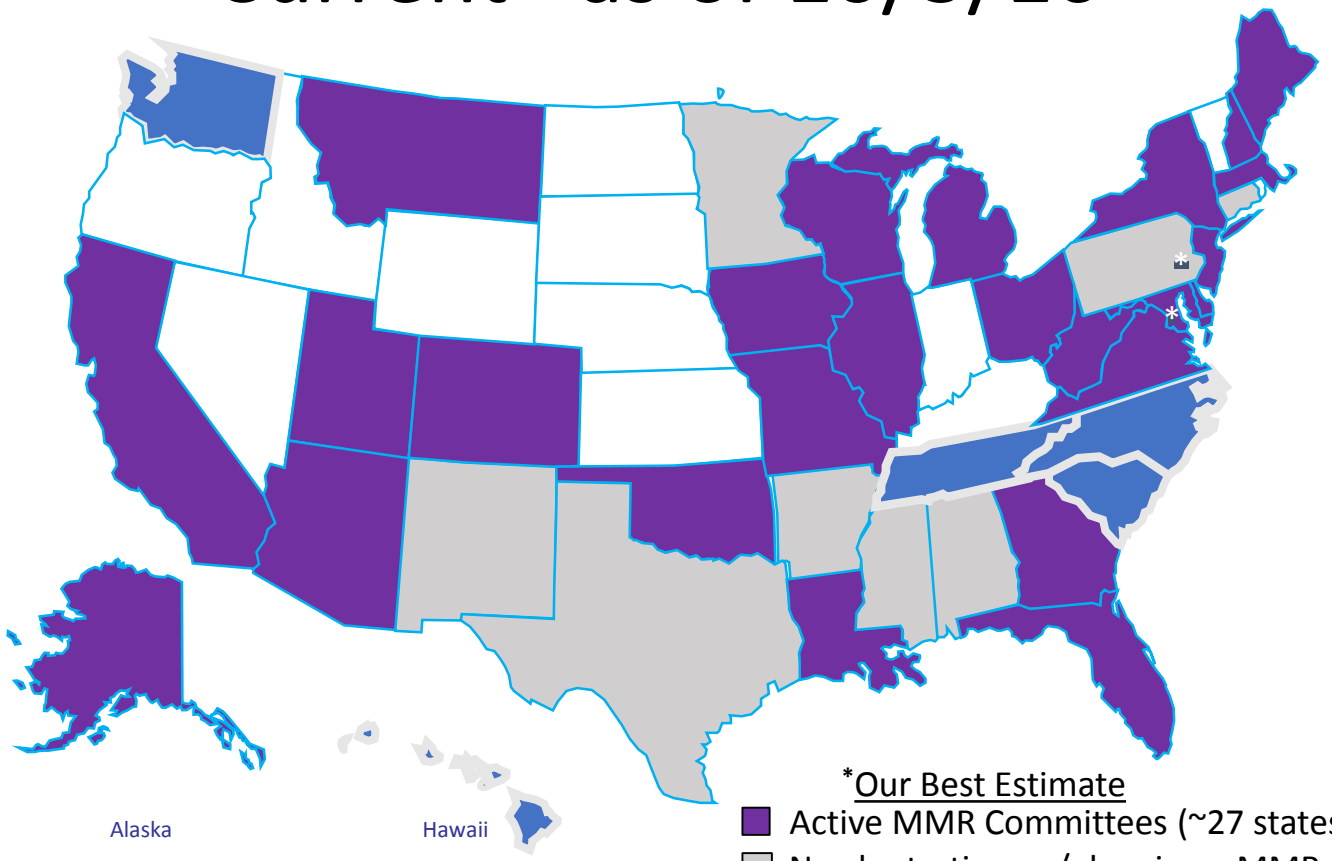
- **Clarify the nature of the problem** – Establish & staff state Maternal Mortality Review Committees to explore in depth the causes of these deaths and if they were preventable (IL study found 32.4% potentially preventable)

- **Improve maternity care systems** – establishment of state or regional *Perinatal Quality Collaboratives* to address clinical care issues

- **Focus on women's public health** – since maternal deaths involve more than childbirth, focus on women's health not just because she might someday have a child, but because *women's health in itself is important*. Can result in women being healthier when they become pregnant and better cared for after they have a baby.

The Maternal Mortality Review Universe

Current* as of 10/3/16



*Our Best Estimate

- Active MMR Committees (~27 states/1 city)
- Newly starting up/planning a MMR Committees (~11 states/DC)
- Unknown/No Reviews (~12 states)
- Legislative support this past session (~5 states)

Source: CDC. Div. of Reproductive Health

www.birthbythenumbers.org




Birth by the Numbers Team

8 doulas








Twitter: @BirthNumbers

Email: birthbynumbers@gmail.com **FACEBOOK: www.facebook.com/BirthByTheNumbers**